PACIFIC DISCOVERY

CALIFORNIA ACADEMY OF SCIENCES

SEPTEMBER-OCTOBER 1959

VOLUME XII · NUMBER 5

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PACIFIC DISCOVERY

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PRE-DISCOVERY

THE DARWIN CENTENNIAL being celebrated this year reminds us that *Pacific Discovery* is somehow affected by evolutionary processes, too. Although it is still recognizably the same magazine it was in its first spring of 1948, it has indeed developed farther in some directions than in others. It has been charged, in a spirit of constructive criticism—even by members of its own editorial board—that *PD* has become less a journal of nature and more a journal of man. Perhaps so. If so, we have yet to hear any reader expression that this is bad. Neither do we wish to have an admitted editoral interest in people and places taken as proof of slight or insufficient leaning toward birds and/or bees. If slant there is, we would like to think it is toward seeing things whole, regarding man as part of nature, and all things as belonging to the world that is, and yielding to the fascination thereof. Nor does this mean we have any less feeling for the fine detail, for the particular flower, fish, or phenomenon of nature, each worth much consideration by itself. Be that as it may, we invite your attention to this issue's Pacific Profiles subject, America's most distinguished living anthropologist, who at the start of his long career was *curator of anthropology* at the California Academy of Sciences! Since the great earthquake of 1906, there has been no department of anthropology in actual physical being at the Academy. We do not know whether it has been at any subsequent meeting of members or council or trustees read out of existence. We like to think of it as still, in spirit at least, part of the institution. Through occasional exhibits in the halls and through the pages of *Pacific Discovery,* the vastly important science of man can be kept a living part of the Academy until such time as a farsighted benefactor comes forward to enable Anthropology, with curator and staff, once again to open its doors as an active department of the California Academy of Sciences. Then the Academy will, as it should, be in a position to fill the most conspicuous gap in permanent public science museum exhibits in the San Francisco Bay Area: the portrayal of man himself, particularly in those aspects which most truly reveal him as part of nature. Meanwhile, *PD* goes on its wandering way, being a journal of nature *and* man, with half the world its beat—a world of such infinite richness that we may vary our pattern almost without limit while keeping to our basic design. *Plus ça change, plus c'est la même chose.*

PD'S AUTHORS

THE ACADEMY'S DIRECTOR, **Dr. Robert C. Miller,** editorializes on a theme quite central to the basic design of the institution—education in its broadest cultural meaning. . . . ¶History-minded **Joseph L. Parkhurst, Jr.,** of Colonia, New Jersey, has turned up a minor but intriguing "first" in Pacific discovery. . . . ¶**Patricia Bailey Witherspoon** makes her home in Denver, Colorado, when she is not roaming the Pacific or on lecture tour somewhere in the U.S. . . . ¶Besides being Mrs. Witherspoon's father, **Dr. Alfred M. Bailey** is Director of the Denver Museum of Natural History and an eminent bird photographer. . . . ¶**Bernard W. Powell** of Glenbrook, Connecticut, is a member of the National Association of Science Writers. . . . ¶**Dr. Francis P. Filice** is an associate professor of biology at the University of San Francisco who has taken part in various Academy expeditions. . . . ¶**Dr. Samuel A. Barrett** is Emeritus Professor of Anthropology at the University of California, Berkeley. . . . ¶Our new columnist who is to reëmphasize *nature* in *PD,* **Dr. Arthur C. Smith,** is Senior Vector Control Specialist in the California Department of Public Health at Berkeley; his home is in Richmond. . . . ¶**Philip Ferry,** world traveler, takes off into space from his San Francisco launching pad. D.G.K.

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THE COVER

KOALAS are San Francisco's favorite celebrities since they have come to the Fleischhacker Zoo. These were taken in their native Victoria, Australia, by Dr. Alfred M. Bailey *(see pages 6–17).*

Pacific Discovery is published bimonthly at Gillick Press by the California Academy of Sciences. Publication office: 2057 Center Street, Berkeley 4. Editorial, Advertising and Circulation offices: Golden Gate Park, San Francisco 18. Annual subscriptions: U.S., $3; Foreign, $3.50. Single copies, 50c. Members of the Academy subscribe through their dues. Entered as second-class matter, February 17, 1948, at the Post Office, Berkeley 4, California, under the act of August 24, 1912.

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

Those Pacific Vikings

Songs and Tales of the Sea Kings: *Interpretations of the Oral Literature of Polynesia.* By J. Frank Stimson [Ua Tane]. With contributions by Van Wyck Brooks and Susanne McConnaughey. Edited and arranged by Donald Stanley Marshall. Peabody Museum of Salem, Salem, Mass. 1957. xlix + 237 pp., frontispiece. $6.50.

This unusual book is a blend of two interesting ingredients. It combines an important interpretation of some of the best of Polynesian oral literature with interesting information about the author, J. Frank Stimson. In fact the introductory essay about Stimson by his brother-in-law, the noted writer and critic Van Wyck Brooks, may well be as engaging to some as the work of the author himself. But the contribution of Stimson, who is already a legend in central Polynesia, is unique. A self-trained ethnologist and linguist, he lived in Tahiti and in other parts of Polynesia for over 40 years. He acquired a knowledge of Polynesian dialects never equaled and, for example, spoke the difficult classical Tahitian language perfectly. To this he added careful research practices which were in part gained as a result of his early training in architecture. The result was the greatest collection ever made of Polynesian songs, ballads, and folklore.

This volume represents a portion of that collection which Stimson has rendered in translation. Under such headings as "In the Beginning," "The Path of Youth," "Daily Tasks," "Royalty" and others, the author has vividly recreated some of the best of the traditional Polynesian literature. Stimson takes perhaps the most literary license in interpreting several of the sea chanteys, and little if any in recasting most of the ballads dealing with death or with the gods. Generally, though, the author has steered a middle course in trying to reconcile the opposing Polynesian literary forms with ours. Stimson has altered the constant repetitions that appear throughout Polynesian literature "to conform more nearly to English poetical standards, thus retaining in English the impression of high poetic quality which in Polynesian is inseparable from rhythmic repetition." The results are smooth-flowing melodic poetry, a delight to any admirer of the "Vikings of the Sunrise." Competent editing and an appreciatory preface by Dr. Donald S. Marshall, an anthropologist who has worked extensively in the area, enhance the book.

W. Patrick Strauss
San Francisco State College.

Where desert sands are ice crystals

The White Desert. By Noel Barber. Thomas Y. Crowell Company, New York. 1959. viii + 205 pp., 26 photos. $4.50.

The 18-month International Geophysical Year 1957–1958 has ended, but its scientific achievements and its narratives of exploration and discovery will be reported on and read about for several years to come. A large proportion of the IGY story took shape on the Antarctic continent, final land field for the explorer on earth. Here was made the last great pioneer land journey, the crossing of the "white desert" of Antarctica. In a splendid and sympathetic piece of journalism, the London *Daily Mail* ace Noel Barber has recounted this epic march of tractors, with sharpest focus on the inevitable "story behind the story," the conflict of personalities between the two famous leaders of the British Trans-Antarctic Expedition.

In his opening background chapter Barber, with the help of a noted American, asks and answers the question what is the worth of all the costly, difficult, and dangerous

(Continued on page 31)

Illustrated Flora of the Pacific States

By
LeRoy Abrams and
Roxana Stinchfield Ferris

VOLUME IV
Bignoniaceae to Compositae

By
Roxana Stinchfield Ferris

This is the final volume of a monumental reference work that illustrates and describes every species of fern, herb, tree, and shrub known to grow wild in Washington, Oregon, and California. Volume IV ranges from Bignonias to Sunflowers, a total of 1,124 species, and features an index covering all four volumes and a key to the families occurring in the Pacific States. As in the preceding volumes, Volume IV contains a description of each plant family, including the genera and species assigned to it, as well as keys, taxonomic references, habitats and geographical distributions, and, finally, a line drawing of each species.

Heavily illustrated. $17.50

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Stanford University Press

The Education of Free Men

EDITORIAL

UNTIL SPUTNIK I appeared in our skies in October 1957, and could be seen with the naked eye as an unquestioned triumph of Soviet science and technology, it had been customary in this country to underestimate the accomplishments and the possibilities of the U.S.S.R. Thereafter the pendulum swung to the opposite extreme. We began to overrate the Soviet achievement, to beat our breasts, to bemoan our own backward status, and to blindly assume that the Russian system of education was far superior to ours and therefore the best in the world.

This was not the assumption of the Soviet Union, which has recently made sweeping changes in its educational system in the direction of *less* education for the average person (from twelve to eight years, plus an optional three of study and work) and more rigorous selection of candidates admitted to higher education. Visitors returning from Russia report an abundance of highly trained scientists and engineers, but a crippling shortage of artisans and technicians. To Western eyes this appears as the inevitable consequence of the lack of a middle class, although Soviet theorists have not yet arrived at this conclusion. Their answer is less education for the masses in order to get them on the production line sooner.

The late Henry Suzzalo, distinguished and articulate educator and university president, used to say that the objective of education in a democracy is to bring every individual to the fullest exercise of his innate capacities. It is fairly obvious that we are not accomplishing this; but it should be equally clear that whatever is wrong with American education can best be remedied in the American way, and not by emulation of any foreign discipline.

Most discussions of education produce more heat than light, and more of the most vocal discussants have very little knowledge of what they are talking about. It is customary for critics to decry "progressive" education, to speak with admiration of the little red schoolhouse, and to call for a return to "the three R's." If I never hear that last phrase again it will be soon enough. If, as I suppose, it means reading, 'riting and 'rithmetic, the very expression smacks of illiteracy. As for the little red schoolhouse, it served a useful purpose in an earlier, sparsely populated and largely poverty-stricken rural America; but we need shed no tears over its passing. The unified school district has paved the way to far better educational opportunities.

I know whereof I speak. I once attended a rural school, and I look back on the experience without nostalgia. It was not red, but white. It was heated by a potbellied stove in the middle of the room. The younger children sat up front and applied themselves to McGuffey's Reader with considerable diligence under the watchful eye of the teacher. The older boys sat at the back of the room, stoked the fire, chewed tobacco, and spat into the stove. Under these less than ideal conditions I did acquire a good deal of information. I also acquired some misinformation, and in particular learned to mispronounce certain polysyllabic words in a way that it took me years to unlearn.

There is a common notion that elementary education was at a higher level in the nineteenth century than it is in the twentieth. I doubt that this is true. Our forebears may have been good at arithmetic for all I know to the contrary, but they were terrible spellers. Ask any historian who has worked with manuscripts of the Civil War period, or—if opportunity exists—read your grandfather's letters. I admit with some reluctance that misspelled words can even be found in the early handwritten minutes of the California Academy of Sciences, although the men who wrote them were doubtless well enough educated to pass off a misspelling as a *lapsus calami.*

As a university teacher of fifteen years' experience in the roaring twenties and the depressed thirties, and as a person who has had a good deal of contact with students both before and since, I am inclined to believe that the literacy quotient of university students today is somewhat lower than it was when I was in college. But this does not in itself indicate a deterioration in the quality of elementary or secondary teaching. A much larger percentage of the total population goes to college now than went at the turn of the century, or even two decades ago. In broadening the base of higher education, it is inevitable that we encounter more college freshmen who can't read, write, or spell.

I do not mean to say that contemporary education at the elementary and secondary levels is all good; I mean rather to say that it is not all bad—certainly not as bad as its critics generally claim. In many respects I think it is better than when I was in school, and in only two respects do I think it is worse: there are too many electives, and there is too little emphasis on hard work.

A student should have his education pretty much prescribed from the first grade until the junior or senior year in college. A young person does not know what he ought to study any more than he knows what he ought to eat. If he is permitted to substitute courses in social attitudes, family relations, first aid, and driver education, for science, mathematics, languages, history, and English, he will suffer from intellectual malnutrition, just as he will suffer from physical malnutrition if he is permitted to live on hot dogs, soda pop, and candy.

I have no objection to so-called "frill" courses provided they are taken as extras. I took manual training in high school and have been handy with tools ever since, something I have frequently found to be of advantage. I took four years of music with pleasure and profit. But I took these courses in addition to the basic curriculum, not as a substitute for something else I should have been studying. I did use the credits in manual training and music toward graduation from high school, and used a corresponding number of credits in Latin and German for advanced credit in college—something that was unusual in that day but is becoming rather common now. A graduating high-

Little Red School House, Nicasio, California—1879. Dedicated in May 1958 as an historic site. (D.G.K.)

school senior is only three months from being a college freshman, and if he has taken sound courses in his senior year in excess of the requirements for graduation, why should he not receive college credit for them?

With those extra credits, a few more that I picked up in college by special examination, a few more by carrying two or three more hours a semester than the college termed a standard load, and one summer session in my junior year, I was able to graduate with an A.B. in three years, and thus gained an entire year in my admission to graduate school, a matter of considerable importance to me.

The lack of emphasis on hard work in our schools today has resulted in a deterioration of standards. As someone has aptly remarked, the modern theory of education seems to be that it doesn't matter what a student is taught so long as he doesn't learn it. This situation has derived I think from a misapplication of the well known principle that one does his best work when he is interested in what he is doing. This has been turned around to mean that a student should not do anything he is not interested in, and this then has been interpreted as meaning he should do as he likes.

Now nobody is going to become prepared for life in a post-graduate kindergarten. What students need to learn is not to do only what they are interested in, but to become interested in what they have to do. That is one of the most important lessons in the world, and anyone who fails to learn it is doomed to lifelong unhappiness and frustration. The joy of achievement comes not from doing what one likes but from accomplishing something that is difficult.

An unfortunate consequence of the do-as-you-like theory of education has been the large-scale abandonment of homework. In my opinion homework is an indispensable adjunct of learning. It fosters independence and self-discipline, because certain projects have to be carried out on the student's own time and without either assistance or surveillance of the teacher. And it gives him at least a glimpse of insight into a basic tenet of all real scholarship—that the pursuit of knowledge requires working after hours.

Most of the current arguments both for and against progressive education are based on the tacit assumption that education is something that is perpetrated on the student, either by his teachers or by the educational system, whereas in fact an education is something a student has to acquire for himself by his own effort. There is no other way. The best the schools can do is to provide a proper environment.

I have interviewed many hundreds of high school graduates over the years, some seeking employment, some wanting counsel on how to prepare for a career in science. Many, I have to admit, have been abysmally and pathetically ignorant, even illiterate. One wonders how they can have gone to school twelve years without learning more by sheer accident. But the best students have been as keen and eager and well educated as any young people of their age in the world. It is clear that, whatever the merits or faults of our public schools, they provide or at least permit an education for those who want it.

The central problem of education is to develop in the student a thirst for knowledge. This is not going to be accomplished by a crash program, or by spending x millions of Federal dollars. The Pierian spring can never be made into a Federal irrigation project. There is, I think, an area for government subsidy in view of the increasing cost of education and of the fact that taxation has dried up many sources of private philanthropy—in view also of the fact that changes in the economy have made it harder to work one's way through college than it used to be. But the real crux of the matter is to find students who will study.

An eagerness for learning may come about in various ways. Perhaps it comes most easily and naturally from the precept and example of intelligent and wise parents. But it may come also—or besides—from contact with an inspired teacher, from the reading of books, from frequenting museums, even from watching television—if the program is *Science in Action, Explorers of Tomorrow,* or some other program of comparable substance. The moment that learning becomes an ambition, a student is on his way and nothing can stop him.

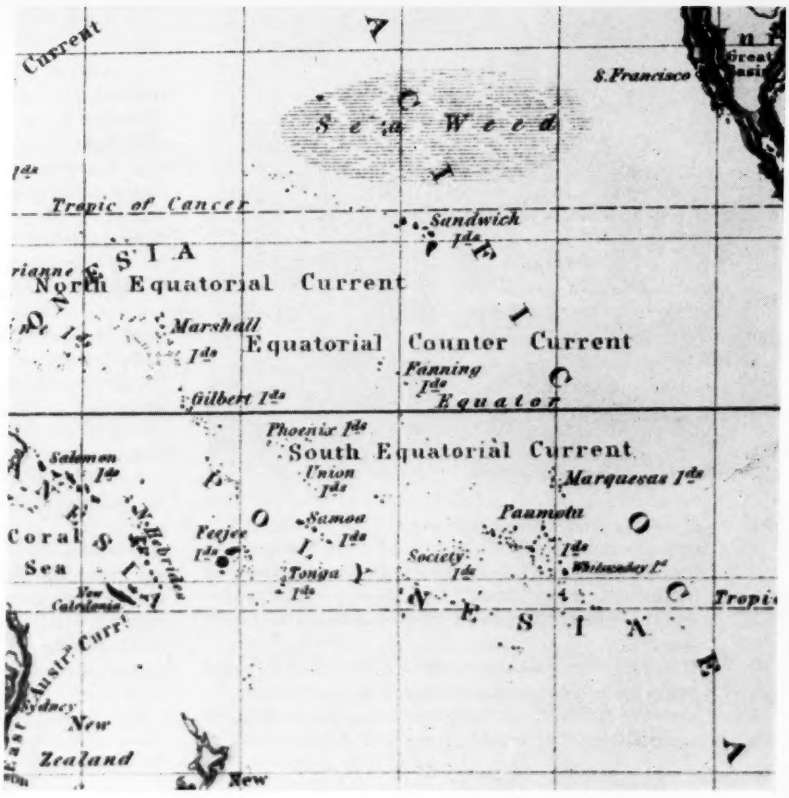
Any reader who has had the patience to read this far will be interested in a new book, *The Challenge of Science Education,** by some thirty distinguished authors. A book of this sort presents so many facets that it cannot be adequately reviewed. But I cannot refrain from mentioning that, in the concluding chapter, Nobel laureate Werner Heisenberg, director of the Max Planck Institute for Physics in Munich, comes forth in defense of a classical education, and states that his own thinking on atomic physics has been illuminated by reading Plato in the original Greek. Which bears out a point we have tried to make above, that learning is a highly personal and individual matter. R.C.M.

* *The Challenge of Science Education.* Edited by Joseph S. Roucek. Philosophical Library, New York. 1959. ix + 491 pp. $10.00.

"BETSEY'S" VOYAGE OF PACIFIC DISCOVERY

☆

Joseph L. Parkhurst, Jr.



ON JUNE, 1797, the brig *Betsey* left New York for the South Seas, and a two-year excursion circling the globe. Her captain, Edmund Fanning of Stonington, Connecticut, was a young man who had gone to sea at fourteen and worked his way to first mate on coastwise schooners. Their business was the procurement of fur-seal skins somewhere around Cape Horn, to be traded in the very profitable markets of Canton, China. To add incentive there was the possibility of finding something unknown to the great circumnavigators of the past.

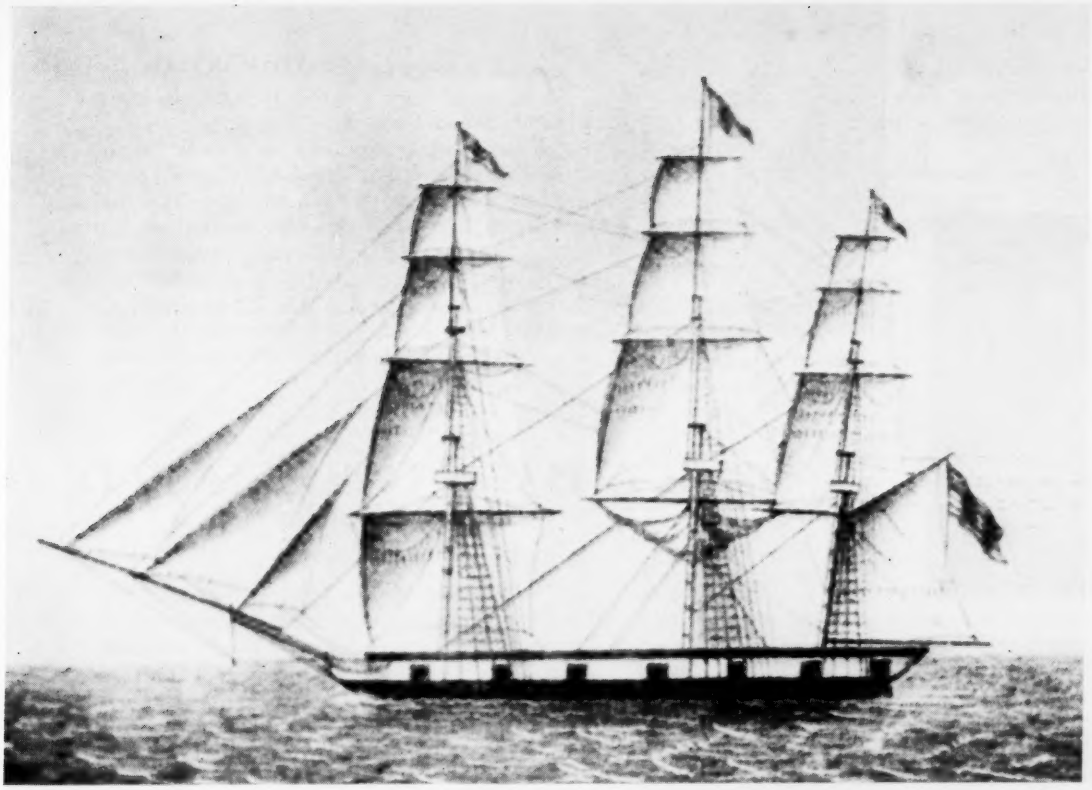
During this tour of the world they would visit a Polynesian king in his court, pick up shipwrecked sailors from the Marianas, and fight off an attack by Malay pirates. In their spare time the ship's carpenters would have the *Betsey* fitted out with enough imitation guns to give her the appearance of a real man-of-war.

We are primarily concerned with incidents taking place in mid-Pacific, in June 1798, mentioned in Captain Fanning's journal. After sailing from the Marquesas Islands he pursued a northwesterly course into uncharted waters and a series of new discoveries. Almost immediately he noticed two strange islands which he did not recognize as more of the Marquesas. They were appropriately named New York and Nexsen, for the *Betsey's* home port and as a compliment to her owner.

Crossing the Equator on June 7th, the ship must have passed fairly close to Christmas Island although there is no mention of sighting it. On the morning of the 11th breakers were seen at a considerable distance, and beyond that the point of some new island. "At 10 A.M. a sea breeze from the north-east sprang up, whereupon we bore away, and sailed along the northern coast to the westward: this island appeared to be one of some extent, and the group to consist of three, all within sight at the same time, and laying in such a position to each other, as in some measure to form a triangle."

After the boat was hoisted and rowed into the lagoon its crew located a grove of coconut trees on the south island, along with evidence that it had no living inhabitants. The fruit was strewn all around from one to three feet deep and appeared to have ripened and fallen for a number of years.

"These islands are situated in latitude 3° 51′ 30″ north, longitude 159° 12′ 30″ west, and as before stated, are three in number, exclusive of the islets. We gave them the name of Fanning's Islands, and by this



The chart: from Guyot's *Common School Geography* (Charles Scribner & Company, New York, 1868).

The *Betsey:* from *Fanning's Voyages,* or *Voyages Around the World* (Collins & Hannay, New York, 1833). The author's copy formerly belonged to Dr. Frederick A. Cook, of Arctic and Antarctic notoriety.

they have been recorded, and remain on the charts in use."

Further remarks in Captain Fanning's journal indicate his concern for other seafaring men coming this way: "There is sufficient depth of water through the passage for any merchant ship to pass in, and on the inner or bay side is smooth and convenient anchoring, which, together with the abundance of wood and water, the tropical fruits, best of fresh fish, and excellent turtle, here to be obtained, make this a very desirable place, for the refitting of a ship, and refreshing a crew."

The next day another island of higher elevation and beautiful green appearance was sighted, and all hands were agreed on calling it Washington. Only a few years before the same name had been given to one of the Marquesas Islands by Captain Joseph Ingraham of Boston, but this may be marked Nukuhiva to avoid confusion.

Captain Fanning records a strange occurrence during the night of June 14th. For the first time in his life he was walking in his sleep, and on awakening seemed to be unusually disturbed about the ship's position. When questioned in regard to this the officer on deck wondered if the captain was all right, and remarked that he might have seen something like land at a distance through the haze. Sensing danger close at hand, the captain left orders to hold the ship where she was and call him at daybreak. At that hour he got up without delay to discover breakers directly ahead, just in time to save them from disaster.

They had almost run into a coral reef of crescent shape, apparently without a foot of ground above water although it was seen plainly with the spyglass. This discovery was left with no designation in Captain Fanning's account and may have been mistaken by him for a nearby atoll named Palmyra. After a half century it was revisited by another American skipper, and since then called Kingman Reef.

Following this narrow escape it was decided not to continue any further on this untraveled route and the ship was steered into the familiar track of Spanish merchantmen bound for Manila. On her return from Canton around the Cape of Good Hope the *Betsey* was slowed down with a fouled bottom, reaching home port in April of the next year. She had achieved a measure of distinction, in addition to the island discoveries, as the first American ship with American-born officers and men to sail around the world from New York.

Patricia Bailey Witherspoon

KOALAS, KOOKABURRAS, AND KANGAROOS

Photos by Alfred M. Bailey

AUSTRALIA was a faraway land, in sailing ship days. It was a half-year journey or more from England southward along the coast of Africa, around the Cape of Good Hope, and eastward across the Indian Ocean to Fremantle on the colorful west coast of Australia. Even today it is a three-week ocean voyage from California to Sydney. By air, however, Australia is a bare 30 hours from all parts of the world. Increasing numbers of visitors are going there, especially to the Commonwealth's southeastern states of Victoria and New South Wales whose rugged coastlines were first seen on April 20, 1770 by Captain James Cook, the English explorer.

John Murray sailing along the stormy shores in his little ship *Lady Nelson* discovered Port Phillip Bay, a natural harbor on the extreme south coast, in 1802. Some thirty years later a village of canvas and wood sprang up along the shores, a town destined to become one of the world's great cities—Melbourne, capital of Victoria, with a population of more than one and a half million today, Australia's second largest city.

Many thousands of Americans became well acquainted with Australia during the war years. Because of its interest in the unique animal and plant life of the vast country, the Denver Museum of Natural History has had four expeditions there to secure specimens for display in three large, panoramic ecological groups. Covering all six states and Northern Territory, the field trips were made in coöperation with the National Museum of Victoria.

As a result of the close association of the Denver and Melbourne museums my father, Dr. Alfred M. Bailey, Director of the Denver Museum of Natural History, was invited to be the guest speaker at the Centenary Celebration of the National Museum and to present a series of film lectures in some of the large towns of Victoria. It was on his third trip to Australia that I was privileged to ramble through this smallest

and most fertile mainland state, and to visit remote sheep stations in western New South Wales.

My first glimpse of Melbourne was at night as we circled in the dark, her lights gleaming below. We were greeted by Museum Director R. T. M. Pescott* and his family, and members of the staff, who previously had been field companions with my father in remote regions of the vast land.

Melbourne is a booming city, with its skyline particularly impressive from along the winding Yarra River, especially in the early morning when dark reflections are mirrored in the quiet waters. Sidewalks sailed along the eastern shores. The building was dismantled, shipped, and carefully reassembled in its new setting. Over a doorway, cut in stone, is the original inscription: "J. C. 1755."

Each day brought new experiences, and an early impression that Australians are the most friendly and hospitable people I'd ever visited was amply confirmed. We have much in common, although there was one difference that was immediately apparent. We spoke the same language but accents differed; ours was the strange one here, we soon realized. I'll never forget the panicky feeling I had when showing

OR: VICTORIANS I HAVE KNOWN

and stores are crowded with shoppers; rush hour traffic compares with our own, except for the left-hand driving as I found to my embarrassment.

There are excellent museums of art, natural history, and science; the University of Melbourne has a very large enrollment; and the outstanding Botanical Gardens in the heart of the city are known all over the world for exotic trees and shrubs and a continuous display of flowers throughout the seasons. There are many beautiful parks, one containing a memento linking Australia with the homeland, England—the cottage of the great explorer, Captain James Cook, who first

*Now Director of the Melbourne Botanical Gardens.

my film, "Mormonland," a story of one of our trips in Utah down the rapids of the San Juan and Colorado rivers, to eight hundred seniors of Melbourne secondary schools. With my first words a titter of amusement ran through the hall. It stopped almost immediately, but I know the young people had to concentrate to follow the narration.

A favorite place for the youngsters is the Melbourne Zoo. Unfortunately, some of Australia's unique species have dwindled almost to the vanishing point or have been pushed into the "outback" as increasing numbers of people have settled the country. Consequently, only in the zoölogical parks will the majority ever be able

Melbourne, the "Queen City" of Australia, grew from a tent village on the Yarra River.

An aborigine—there are only a few in Victoria—visited the Denver Museum Expedition camp on horseback.

to see bounding kangaroos, lovable koalas, fleet-footed emus, or the most primitive of all mammals, the egg-laying duckbill platypuses and the spiny anteaters known as echidnas.

The fauna of Australia is unlike that of any other country. Geologists believe that the continent was separated from lands to the north in the late Cretaceous when only primitive mammals were on earth. Most of them disappeared in other parts of the world, eventually, because of competition from placental animals, but marsupials and monotremes isolated "down under" were able to survive. It was at the Melbourne Zoo that I first became acquainted with many species I was to see later in the wild. Joyce Seekamp, publicity director, allowed me to hold "Florabelle," the same little koala which had been presented to Queen Elizabeth on the occasion of her visit to Melbourne.

There are many places not far out of Melbourne where the nature-minded visitor may go. Healesville Sanctuary has kangaroos, wallabies, and emus wandering at will through the paddocks. One of the most interesting of all birds was the brush-turkey,* a large species famous for its nesting habits. The male had built a mound five feet or more in height, in which the female had laid her eggs, to be incubated in the heat generated by the decaying debris. It takes over fifty days for the eggs to hatch and throughout this long time the male keeps the mound in repair. We watched one, his bare head and wattled neck conspicuously marked with red and yellow, as he climbed to the top of the mound, where his dark plumage blended with the heavy shadows. He gave a few kicks, and then slowly started down the side; he would reach forward and grasp a footful of soil and sticks and give a vigorous thrust backward and upward, filling the air with flying nest material.

One afternoon with Mr. Charles Brazenor, who has since succeeded Mr. Pescott as director of the Museum, we circled along winding roads to Sherbrooke Forest in the high Dandenong Range which is seen as a distant blue ridge thirty miles east of Melbourne. The dense wooded area is the habitat of the famed lyrebird and I had looked forward to this visit. We walked silently with eyes and ears alert for lyrebirds. Sherbrooke seemed liked a fairyland—a heavy mist mysteriously shrouding the nearly impenetrable fern forested jungle. The tops of the trees, the tallest of the eucalyptus, were hidden by fog and long fronds of the tree ferns were dripping with moisture. There was a flashing of wings of scarlet king parrots and their cousins, the crimson rosellas, and kookaburras were giving their well-known raucous serenades.

As we walked quietly along the trail, we saw a female lyrebird among the shadows as she energetically scratched the ground,, reaching forward and throwing the debris backward, similar to the way the brush-turkey worked. She was most thorough as she scratched for food. Then we heard the characteristic notes of a male and Mr. Brazenor led the way through the tangle. I shall always remember the lyrebird's performance from his strutting mound in a clump of bracken as he quivered his long lace-like tail feathers and gave loud clear calls mimicking all of the other birds of the forest. His imitations were so real that had

* See also "The Mound Builders" by Harold James Frith, *PD*, September-October 1956.—Ed.

we not been watching it would have been hard to believe such varied notes came from the one bird. In the gloom of the heavy woods there was not light enough for motion pictures, nor could we get within range for a strobe shot before he moved off through the heavy wet underbrush. We had to be satisfied with a few pictures of a smaller male and several females.

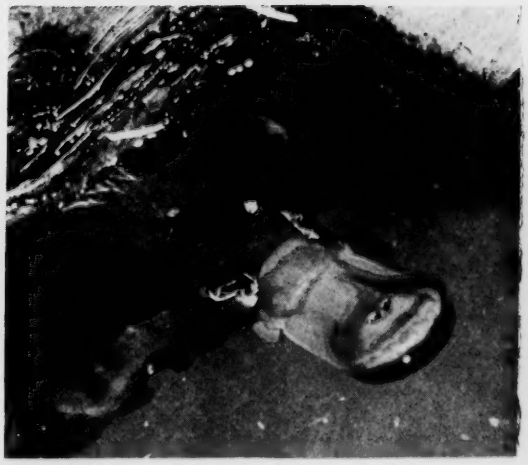
After our few hours in Sherbrooke Forest we drove to the home of Mr. Hal Scott not far distant. One of the nice customs in Australia is having tea several times a day. At Mr. Scott's we were served the usual cheese, tomato, and ham sandwiches and individual sponge cakes heaped high with whipped cream. At the same time we watched the coming and going of Mr. Scott's tame kookaburras, the famous "Jacks" with the unearthly laughs. His large land kingfishers spent the day roaming the forest, and every evening before sundown a half dozen or more would come to the porch railing to be fed raw steak. Each bird waited his turn, hopped onto Mr. Scott's arm, grabbed the meat, and then flew back onto the railing to await another turn.

Close to Melbourne is the large Yan Yean Reservoir, the first to supply water for the fast growing city of Melbourne. With Charles Brazenor and John McNally, biologist of the Fish and Game Department, we made an early start and reached the wood-lined lake by the time light was strong enough for pictures. Ray Kermode, District Engineer, gave us a personal tour to show us the numbers of gray kangaroos finding safety in the forests.

The public is excluded from the area for fear of the water supply becoming contaminated, so the five thousand acres of the reservoir make a natural sanctuary for wildlife. The timber is thick but fire lanes had been cut through the forest and we stationed ourselves along one. Then Mr. Kermode made a circle with the car and the noise of the motor sent kangaroos, ranging from little joey's hopping alongside their mothers to old man grays, more than six feet high, bounding from the shadows of the woods across the sunlit strip of fire lane and into the darkness beyond. One large male pausing in an open glade gave me an opportunity for a picture in a nice setting. We must have seen three hundred kangaroos in an hour and a half as they leisurely spanned twenty feet at a jump, a long line of them following the leader.

Weather conditions around Melbourne can be discouraging, as on the gray, chill, and gusty day we went westward along the shores of Port Phillip Bay to Altona (stopping at Mr. Brazenor's on the way to film his pet sulphur-crested cockatoo). There we called on Charles Tanner, one of the well known herpetologists of the country, who has the uncanny ability of handling Australia's most venomous serpents. In his back yard was a small enclosure literally filled with large black tiger snakes from one of the islands of Bass Strait.

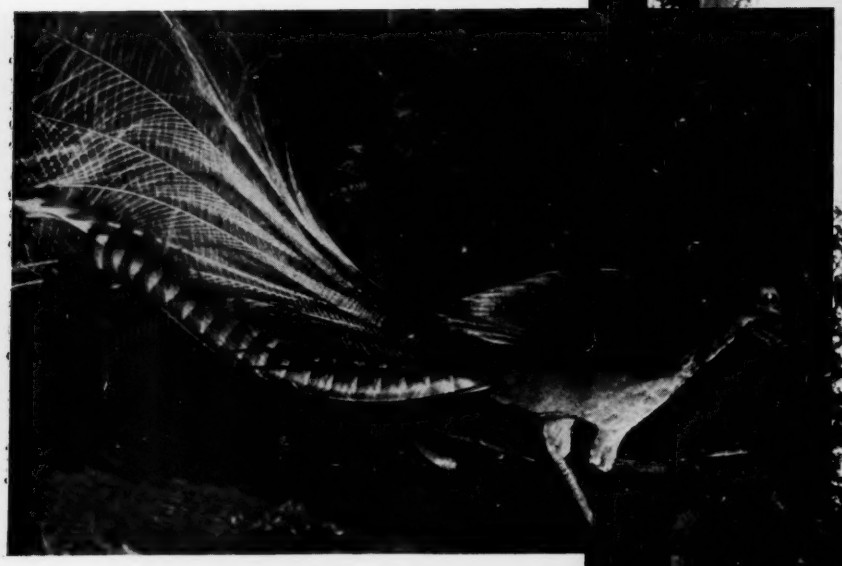
They were vicious looking creatures to my preju-



The platypus has soft fur. (Below, tip of the "duckbill" with nostrils above water.)

An echidna, or spiny anteater, bristles in its hollow-log nest.

The lyrebird, female (above) and male (below) in Sherbrooke Forest.



Australians delight in taking visitors to famed Sherbrooke Forest in the Dandenong Range east of Melbourne, where stately eucalypts and an undergrowth of ferns and shrubs form the habitat of the lyrebird.

diced eye, beautiful to Mr. Brazenor and my father. Without hesitation, Mr. Tanner stepped among the tigers, picked up a dozen of the longest by their tails, one at a time, and dropped them into a burlap bag. None of the reptiles had been defanged, or handled to any extent. My father set up his movie, exposing film as the snakes were slowly dumped on the ground; then Mr. Tanner reached down, picked up an arm load of potential death, held them chin high and—not a snake offered to strike!

Mr. Brazenor considers the tiger one of the most dangerous reptiles with a toxicity fifteen times that of the cobra. Based upon the average amount of venom available in a single milking—depending on the size as well as the fighting fitness of the snake—the tiger would yield 118 lethal doses for domestic sheep as against 31 for the cobra. No human statistics exist for, to quote Mr. Brazenor, "egotist that he is, man objects to being used as an experimental guinea pig."

Toward mid-afternoon we arrived at the Altona salt evaporation flats where hundreds of graceful silver gulls were nesting in small lakes on mounds of debris left after the salt accumulation had been gathered. Members of the Royal Australasian Ornithologists' Union using the area as an outdoor laboratory had banded over one thousand young gulls in six years' time in order to get accurate life history data. Nesting was well under way. As we waded from one mound to another we noted nests with three eggs, others with downy young and oftentimes large half-grown birds with wing quills well formed swimming from one little island to another. Overhead hovering parents directed traffic with shrill calls of alarm.

Out in the choppy waters of a broad estuary, nearby, was a straggling flock of black swans, the finest game birds of the country. Occasionally a half dozen or more would run over the surface with flapping wings and splashing feet gradually rising into the wind. These swans, once limited to Australia, were first discovered by the Dutch navigator Vlaming in 1697 in the vicinity of Perth, the capital of Western Australia. Many thousands of swans were slaughtered as game during past years but now they are carefully protected by law. The black swans are familiar birds of zoölogical parks all over the world and in the northern hemisphere they have changed their breed-

Herpetologist Charles Tanner has confidence in his black tiger snakes.

A denizen of Bass Strait islands, the black tiger snake is one of Australia's deadliest reptiles.

ing season to coincide with spring in their new environment.

Australians have become highly conservation conscious, being concerned in recent years over the fast disappearance of forested areas and the threatened extinction of some of their unique animals. As a consequence large tracts are being set aside as parks where wildlife will be protected.

One of the most noteworthy is Wilson's Promontory National Park on the southeastern tip of the continent along the rugged coast of the Southern Ocean. It is 145 miles by car over winding roads from Melbourne to this picturesque spot and there we were privileged to spend a week end.

En route we saw small bands of emus and wallabies in low scrub. Topping a ridge at the end of our journey, there was a nice view of the Tidal River with white painted cabins, where we were to stay, along the shores. To the left was Mount Oberon, possibly first sighted by white men on January 2, 1798 when the explorer George Bass reached Wilson's Promontory.

Around camp were groves of *Banksia* trees, named for Sir Joseph Banks, the noted botanist who sailed with Captain Cook on his journey of exploration. The golden upright blossoms were conspicuous against the dark shiny leaves; small flocks of crimson rosellas and the brilliantly dressed rainbow lorikeets hurtled from one tree to another to feed upon the hard fruit in the seed cases.

That night we pulled a seine at the mouth of the Tidal River under the light of a moon that threw broad beams of gold onto the darkened waters of the Southern Ocean. Returning along the footpath with bags of mullet, flounder, and crab, Mr. Brazenor threw the light of his torch into the shadows of the heavy vegetation. Occasional glowing coals seemed reflected in the light, which upon closer inspection proved to be wombats at their burrow entrances. These piglike animals—strong limbed marsupials—were living in holes they had excavated with their sharp claws. Twice we were within ten feet before the wombat dived from view, and once we saw one old fellow out in the open feeding upon green vegetation. Disturbed by our lights and voices, he lumbered slowly away, pausing momentarily to look back.

Our party climbed Mt. Oberon which rises 2,000 feet above the camp, and from the summit we were rewarded with a splendid view of the beach below. A few hours later we hiked over the two-mile stretch of pure white beach called Squeaky Bay because the sand, ground fine from the water beating on the quartzite rock cliffs, really squeaks as one walks along. The great smooth-surfaced granite rocks sloped gently to the water's edge with only a narrow piece of land separating the white sands of Squeaky Bay from the common yellow sand of the adjacent beaches. It was exhilarating to be pushed along by the cold wind that sent frothy combers slapping upon the shore and to hear the constant beat of the lapping waters. Far into the ocean, rocks projecting from the sea reminded us that there were only a few isolated islets to the south between us and the Antarctic Continent. Little bivalves pushing their way underground patterned the sand; feeding on these and other crustaceans were the silver and Pacific gulls, dotterels, and oystercatchers, while overhead sailing with the air current were dark cormorants.

Going back to the cabins overland we climbed the sandy cliffs and saw many flowers, the most conspicuous the red correa (*C. rubra*) known locally as the native fuchsia. The black sheoaks, conspicuous trees, had brownish new growth resembling the feathers of cassowaries.

Our journey back to Melbourne took us to the seaport village of San Remo where a suspension bridge crosses to Phillip Island, a number one conservation project of Australia. Alfred D. Butcher, head of the Game Department of Victoria, met us here to show us the sanctuary for their beloved "Teddy bears"—the koalas. These strange marsupials were once numerous in the eastern part of Australia but thousands were killed for their hides, and destroyed by the deliberate burning of the forests to make open spaces for grazing.

Conservationists became seriously concerned whether or not koalas could be saved from extermination. Now thanks to wise laws they are carefully protected; sentiment has placed this unique little mammal high in popular esteem. Phillip Island is a natural sanctuary for there are many acres of manna gums, one of the favored food trees of the koala. Last year, however, it was necessary to remove two hundred from Phillip Island because bush fires had destroyed many of the eucalypts. Unfortunately, the new shoots of burned trees, unlike regular foliage, contain cyanide, which brings paralysis and death to these animals.

Strictly Australian, the koalas feed almost exclusively on eucalyptus leaves. There are more than 500 kinds of eucalyptus but the little animals are such choosy fellows they will eat the leaves of only four or five species. Because of this restricted diet it has been difficult to increase their range.

We were afield early when the first light of morning was bathing the tops of the green forest and in the shadows beneath the trees voracious mosquitoes welcomed our arrival. Here and there, high in the trees were slow moving koalas, out on slender branches or sitting in crotches, lazily taking in the warmth of the morning sun or reaching out with sharp-clawed forefeet to draw in branches of leaves. Starting at the stem, they would bite off a cluster of leaves and then slowly chew until finally the tips and all disappeared.

As I watched them, I marveled at their big appetite, and realized that here were the original gum chewers. There was dew on the leaves, so although the koalas were presumably non-drinkers, they must have been getting moisture they needed.

At noontime we drove to the seaport town of Cowes, a resort of the summer months when the intense inland heat sends holiday seekers to the coast. In December, January, and February when temperatures soar to 100° or more, great crowds come to Cowes and similar beach areas to enjoy the sea breezes. Now, in April, in the fall of the southern year, the little village was practically deserted, and the long sandy beach was our exclusive property.

Toward dusk we cruised slowly along the narrow roads watching for koalas, which seemed most active then and early in the morning. At the edge of the forest we saw a mother walking with a joey, her small baby, on her back. In this posture the pair looked very much like baboons of Africa. The koala seemed unconcerned at first, then she bounded away for the nearest tree with her baby holding tight. She made a leap for the trunk, but missed her grip and tumbled ignominiously into the shrubbery. Recovering quickly, with her rider still holding on for dear life, the old one made a successful second jump and quickly climbed to a limb out of reach to look us over calmly. The light was far too poor for pictures without the use of our strobe, but both animals posed without blinking their beady eyes when an exposure was made.

Koalas are not remotely related to the bear family, notwithstanding their affectionate nickname. They are marsupials, like the majority of Australian mammals. The females give birth to one, or rarely twin babies. A young one is exceedingly tiny, weighing only 5.5 grams, and is barely three-fourths of an inch long. The naked creature crawls unaided into its mother's pouch where it lives for six months until its skin is fully furred and its limbs developed. Then it rides pickaback or is held in its mother's arms. After nearly a year a youngster is ready to strike out on its own; it is fully grown at four years and is said to live to an age of twenty.*

We circled the island, stopping at a point overlooking the Knobbies—rugged wave lashed rocks where large numbers of fur seals were congregated. There were cows and calves and old bulls lazily sprawled among rounded boulders. These animals were badly persecuted in the early days when their skins were taken for the fur trade, but now thanks to protection they have increased.

Phillip Island is noted for its colonies of seabirds, the most famous being those of fairy penguins and slender-billed shearwaters. The latter, called "mutton birds" here, nest in burrows on islands of Bass Strait and after the breeding season migrate northward across the Equator. By this long flight, these shearwaters have perpetual summer, just like the Arctic terns and other species nesting in Alaska which migrate into the South Pacific. The mutton birds have a circular migration, going northwest along the shores of Japan then north, skirting the Asiatic coast to the Bering Sea, and then through Bering Strait into the Arctic Ocean. My father has collected specimens off Point Barrow, more than three hundred miles north of the Arctic circle. On their return flight, the shearwaters follow the west coast of North America and then southwest across the Pacific to Australia—truly a remarkable journey. No wonder my father was so pleased to see these old friends of Arctic days upon their breeding ground in Australia.

Geoffrey Clark of the Game Department led us just at dusk among the burrows where we broke knee-deep into the loose soil. Excavating a tunnel he drew out a sharp-clawed brownish bird, with "tubed" nostrils indicating its relationship to albatrosses.

Later in the evening, long after dark, we returned to the colony. The air was filled with fast moving shadows as adults that had been out at sea all day returned to change nesting shifts. Pairs sat around at

Patricia Witherspoon and Florabelle at the Melbourne Zoo.

* See also "Aussie Ambassadors" by Ken Stott, Jr., *PD*, July-August 1952.—Ed.

burrow entrances, each bird trying to outscreech its neighbor. There was a caterwauling of the hundreds of shearwaters and we realized why they are known as the moaning birds. We tried taking a few photographs as they flew overhead and took pictures of others upon the ground. The shearwaters are called mutton birds because they are considered good eating. Thousands are "harvested" in Australia and New Zealand.*

In the tussock, closer to the sea, were other holes, looking much like those of the moaning birds; but on excavating a few we found fairy penguins, the smallest of their tribe, incubating their two white eggs.

Perhaps our greatest treat at Phillip Island was to watch the landing of these mites of the penguin world as darkness settled over the Southern Ocean; for half the population was at sea during the day, and these birds returned at nightfall to join their mates. We arrived just at dusk at Surf Beach, a deeply indented cove with a shoreline of fine sands where long lines of breakers surged in upon the smooth shore. There was a chilling wind that made us aware that the Antarctic was not too far south.

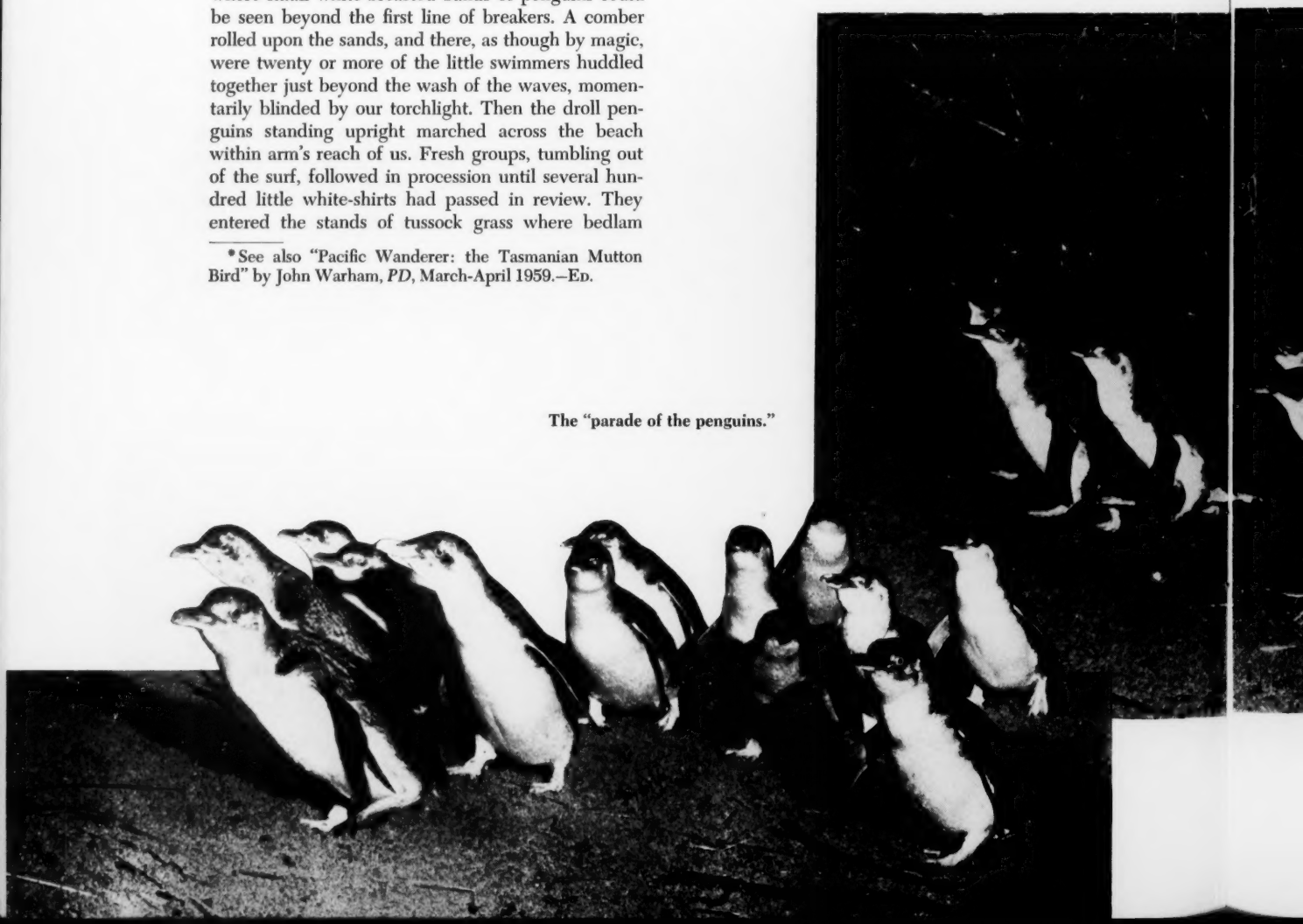
Gradually darkness settled over the grass topped dunes. We threw the lights of our torches seaward where small white-breasted bands of penguins could be seen beyond the first line of breakers. A comber rolled upon the sands, and there, as though by magic, were twenty or more of the little swimmers huddled together just beyond the wash of the waves, momentarily blinded by our torchlight. Then the droll penguins standing upright marched across the beach within arm's reach of us. Fresh groups, tumbling out of the surf, followed in procession until several hundred little white-shirts had passed in review. They entered the stands of tussock grass where bedlam prevailed, the screeching penguins adding their chorus to the astounding serenade of the moaning birds, the shearwaters.

This "parade of the penguins" has become exceedingly popular with nature-minded Australians, so scarcely a night passes during the nesting season without a few spectators crouching on the sands with torches bouncing light off the satiny white fronts of the little seabirds.

Our itinerary took us to some of the country cities of Victoria where illustrated programs were given as part of the Centenary Celebration of the National Museum. In each city hall we were honored as overseas visitors in a Civic Reception by the Lord Mayor and a group of citizens. After welcoming speeches by the mayor and members of the council all would tip their glasses in a toast "to the Queen" and then to the American guests. Then followed refreshments of the customary cakes, sandwiches, and drinks. Such attention, we found, was typical of the hospitable Australians who at every opportunity went out of their way to make our visit memorable.

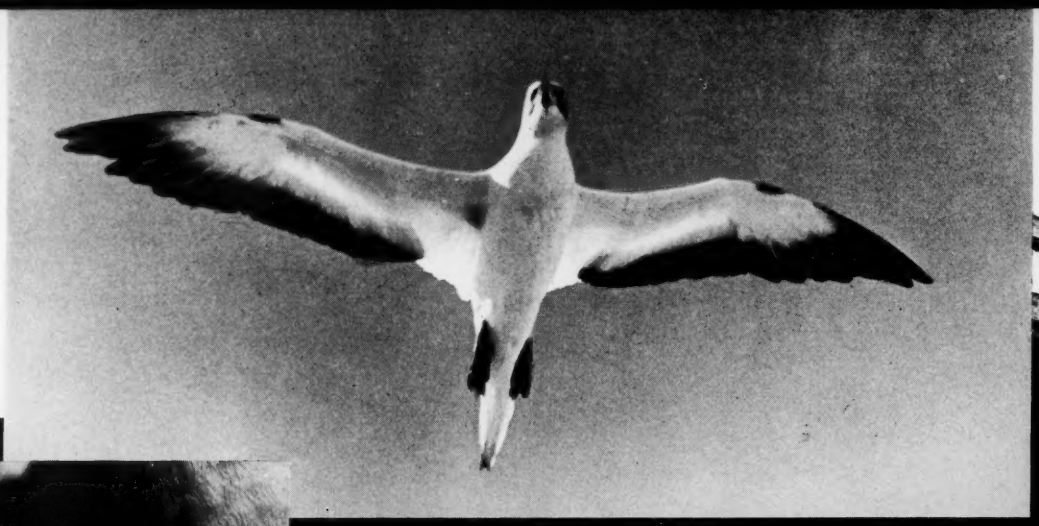
(To be concluded)

*See also "Pacific Wanderer: the Tasmanian Mutton Bird" by John Warham, *PD*, March-April 1959.—Ed.



The "parade of the penguins."

Young
fairy penguin
on its nest.



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AMONG AUSTRALIA'S

PH

3 4

1 Pardalote
2 Australian gannet
3 Australian coot
4 Yellow robin
5 Podargus (young)
6 Silver gull
7 Wedge-tailed eagle (young)

'S BIRDS 5

PHOTOS BY ALFRED M. BAILEY

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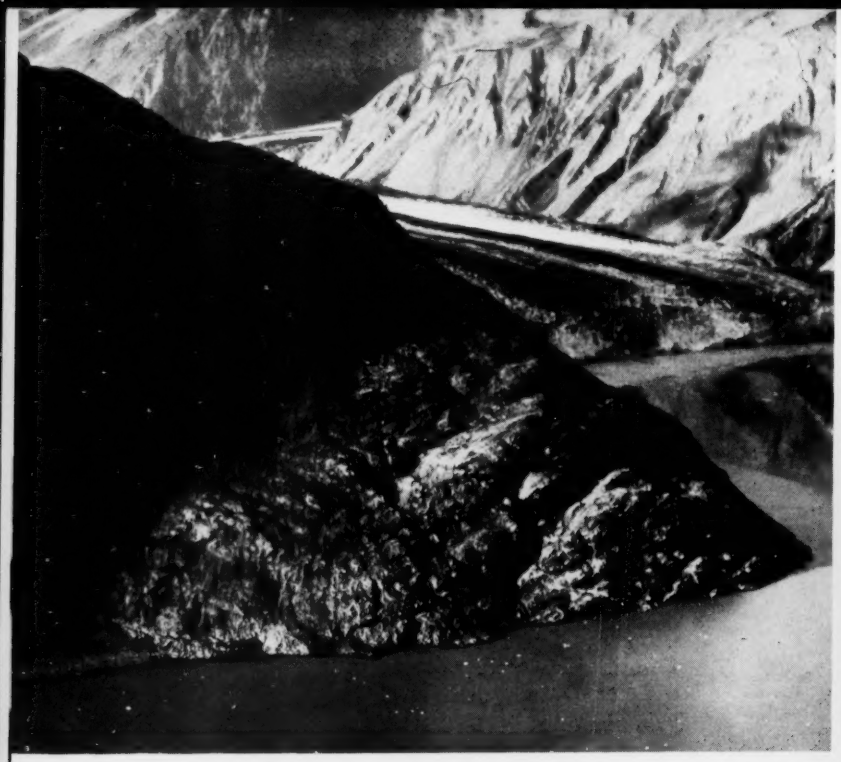
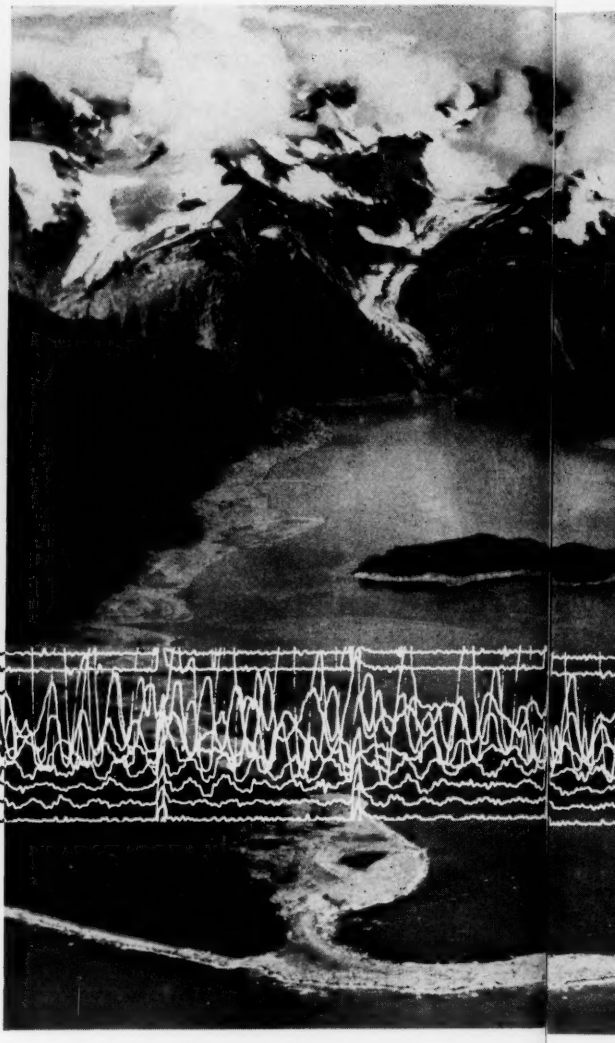
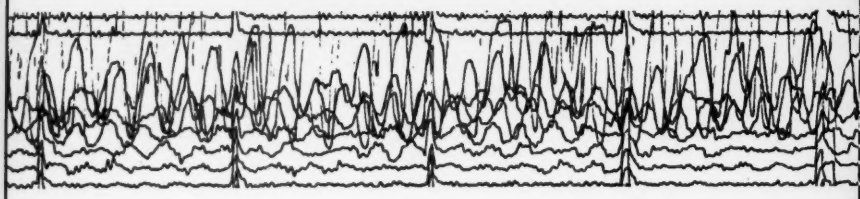






BERNARD W. POWELL

SINCE EARLIEST TIMES activity in the great seismic belts which fringe the Pacific has affected the ways of man and nature. One of the most recent earthquakes to cause heavy damage occurred in the area around Alaska's Lituya Bay on the night of 9 July 1958. Damage in this case was mostly confined to denuded forest slopes, but a few isolated fishing boats also felt the effects of the temblor.

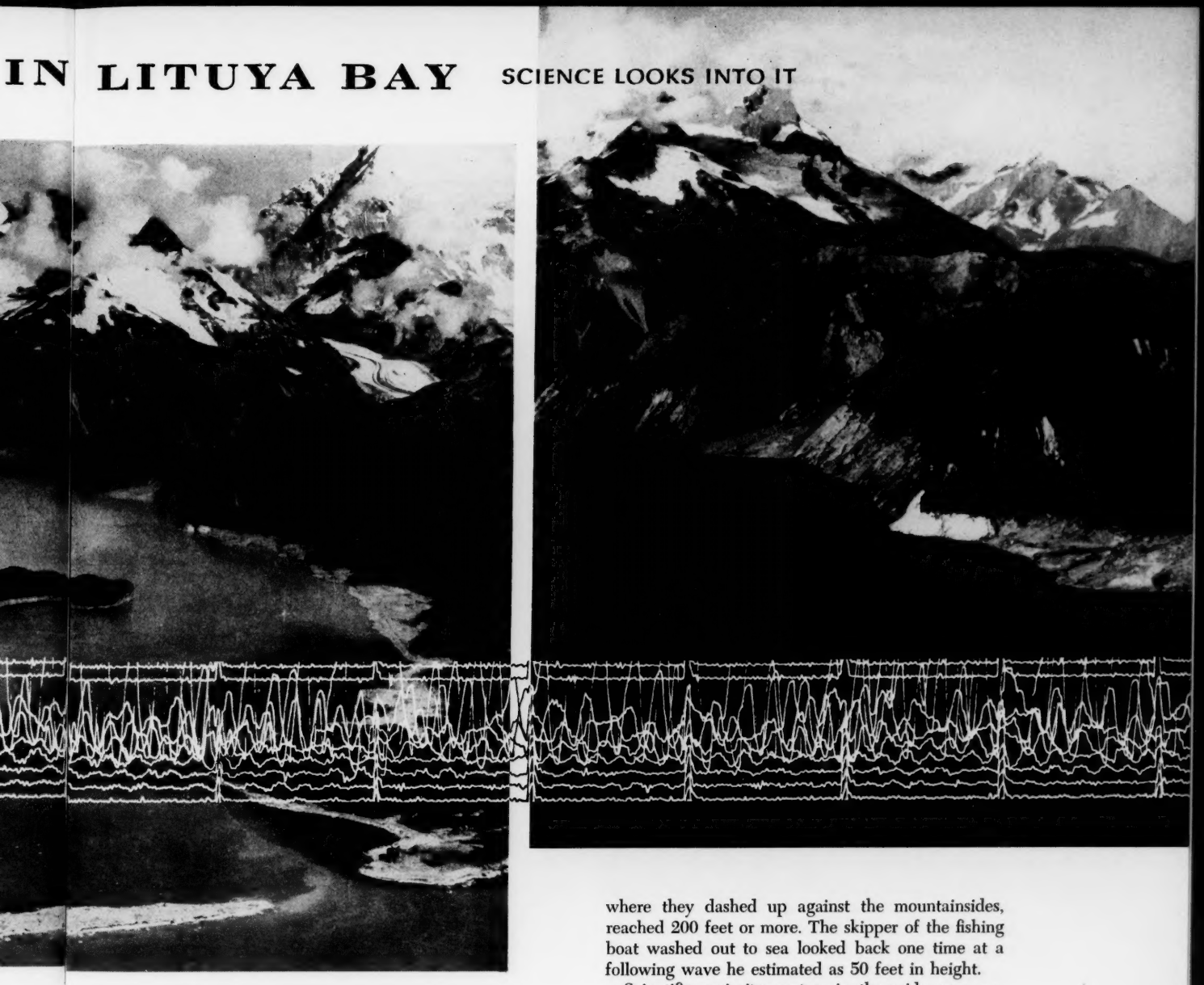
The epicenter, or apparent source, was in the Fairweather Range, a group of coastal mountains near Lituya Bay. The bay itself is a small land-locked harbor on the southeastern coast of Alaska. The U. S. *Coast Pilot* describes Lituya Bay as affording protective anchorage in all weathers. It is T-shaped, and from its entrance extends about six and one-half miles to the northeast. Near the center is Cenotaph Island, so named because the French explorer, Jean-François de Galaup, Comte de la Pérouse, erected a wooden monument there in 1786 in memory of men lost at the harbor entrance.

Seismologists with the U. S. Coast and Geodetic Survey say their records indicate that on the night in question a shock registering between 7.75 and 8 (the famed San Francisco earthquake of 1906 was rated at 8.3), occurred in the Fairweathers. This was the severest temblor felt in this region in nearly sixty years. More than 200 aftershocks were noted. The main shock was felt as far away as Seattle (where a group of twenty musicians in a floating concrete orchestra pit reported its oscillating for a full five minutes!).

A fishing trawler anchored in the harbor was

The CENTER photo shows the entrance to Lituya Bay, after the quake and giant wave of 9 July 1958. At the far end may be seen the arms to left and right that make the bay T-shaped. The LEFT photo is a close-up of the point around which the left arm bends. It has been violently stripped of its timber to a height of 1,800 feet. The RIGHT photo is a close-up of the other side. (Official photographs, U. S. Coast & Geodetic Survey)

IN LITUYA BAY SCIENCE LOOKS INTO IT



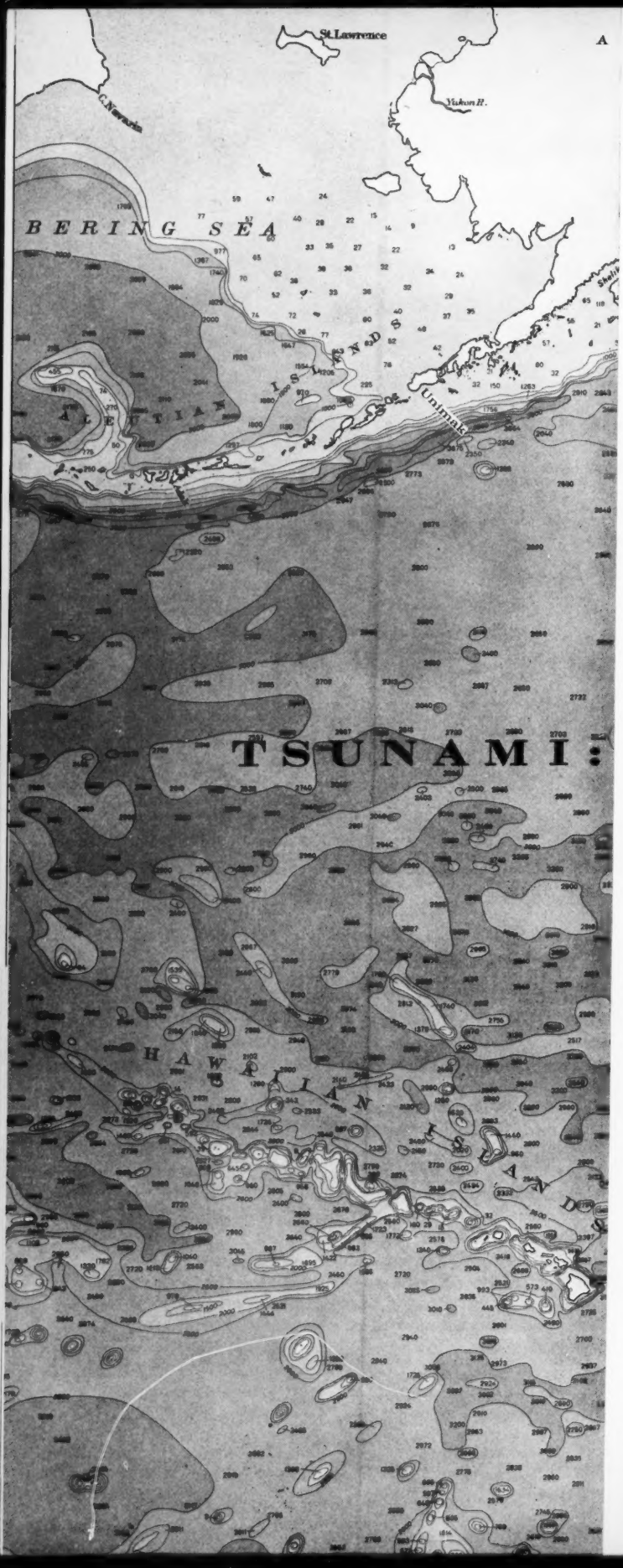
washed out over the spit at the mouth of the harbor on a wave reported by the skipper to be about 100 feet high. The captain's wife was aboard with him; both were subsequently rescued. Not so lucky were the captain and crew of a 55-foot fishing boat also anchored in the harbor at the time of the earthquake. This boat was picked up and dashed against a cliff and no trace of either it or its passengers has ever been found.

The cross-piece of the T that forms the bay terminates in the nearly perpendicular faces of two glaciers. Heavy avalanches and falls of glacial ice dislodged by the quake generated a series of great waves that swept the bay. The Survey found evidence that the waves, where they dashed up against the mountainsides, reached 200 feet or more. The skipper of the fishing boat washed out to sea looked back one time at a following wave he estimated as 50 feet in height.

Scientific curiosity centers in the wide scar, apparent in recent aerial photographs, along the northwest shank of the T. The cliff there rises more than 3,000 feet at an average slope of 56 degrees. Some tremendous force scraped the side of the mountain clean. Two seismologists, James N. Jordan and Rutlage J. Brazee, who have written a technical paper on the earthquake, say only: "This face has been denuded to a height of 1800 feet either by avalanche, wave action or a combination of the two."

Although the havoc was most spectacular in Lituya Bay, damage was also caused farther north, in and near Yakutat Bay. There, a party in a launch saw a spit of land named Turner's Point rise about 20 feet into the air and then sink, carrying three persons to their deaths.

The jagged line band is an exact-size portion of the seismograph record at the California Academy of Sciences, San Francisco, 9 July 1958. Science is still looking into this event. Other references are: *Science*, 13 Feb. 1959, pp. 394–5, an article by Don Tocher and Don. J. Miller; and *Bulletin*, Seismological Society of America, Nov. 1958, p. 406. Don Miller of the USGS writes *PD* that he is now completing a fuller paper, and that interpretations differ somewhat.



The ocean floor quaked off the Aleutians, and

ANYONE WHO HAS LIVED *through an earthquake is impressed by the great energy this unstable earth can unleash. To feel a large building suddenly trembling like a leaf arouses our deep respect for the power inherent in natural phenomena and an appreciation of the relative insignificance of our works. Awe-inspiring as earthquakes may be, however, they are but child's play compared, in effect, to the gigantic and terrifying thing we call a "tidal wave."*

THE HAWAIIAN ISLANDS, associated in everyone's mind with romance and enchantment, have experienced more than their share of huge oceanic waves—"tidal waves." This archipelago lies along a ridge which extends northeastward across the central Pacific for 1,600 miles. The sea offshore is deep; the floor is as much as 12,000 to 18,000 feet below the surface. Due north of these islands, 2,200 miles away over the open sea, another island chain crosses the top of the Pacific Ocean, stringing out from the Alaskan coast and separating the Pacific from the Bering Sea beyond. These are the Aleutians. Immediately south of them, at the extreme northern edge of the Pacific, the bottom reaches great depths to form a trench 25,000 feet deep paralleling the island chain.

TSUNAMI: DESTRUCTIVE C

Like the other submarine trenches that furrow the Pacific rim, this one along the Aleutian Islands has an unstable configuration.

On 1 April 1946, at 58.9 minutes past 1:00 A.M. Hawaiian Time, a major change took place in this trench south of Unimak Island at 53.5° north latitude and 163° west longitude. Exactly what took place is not known, but it must have involved fault movements on a grand scale. As usual, a violent earthquake accompanied this faulting. But besides these earth waves, the faulting set up a series of waves in the sea that radiated out from the epicenter at great speed. This wave train sped across the ocean at an average speed of 489 miles an hour with more than 120 miles between the crests of succeeding waves. Practically none of the energy was expended in lifting the water as they passed so that on the open sea the waves appeared deceptively small, not more than two feet high. A ship at sea would hardly notice them. But when these waves began to shoal in the vicinity of the Hawaiian Islands a change in form took place. As the ever-shoaling bottom interfered more and more with the movement of the water particles transferring the waves, the wave train was slowed until it was going only 15 miles an hour. At the same time the crests were com-

Configuration of the North Pacific Ocean bottom between the Aleutian Islands and the Hawaiian Islands. Note the Aleutian Deep, which reaches 4199 fathoms or about 25,200 feet. (Part of U. S. Hydrographic Office Chart 5486; contour interval, 500 fathoms)

ians, and a 489-mile-an-hour deadly wave train lashed southward upon Hawaii

E OCEANIC WAVES

FRANCIS P. FILICE

pressed together. The energy of each wave, no longer used to maintain its great speed, was used to raise the water. The sea was humped into a huge wave with a steep-walled front. The crest was flat, like a plateau. Then these water mountains crashed on the enchanted Hawaiian shore to spread devastation and death.

The first wave reached Honolulu at 6:33 A.M. at a time, fortunately, when the tide was three-quarters in its recession to low tide. This wave was small. Each succeeding wave was larger until the third wave raised the water on the northern shores of the islands as much as 55 feet above sea level.

The behavior of the larger waves varied greatly from place to place depending on the subtidal topography offshore and the degree of exposure to the source. For example, at Haena Bay on the north side of the Island of Kauai, only a gentle rise was noticed on the west side of the bay; half a mile farther east, however, the waves rushed on shore with a violence that flattened trees and destroyed houses and reached heights as great as 30 feet. At the head of the bay the water rose still higher but with no great wildness. In fact, two women were standing in front of their houses, one with a baby in her arms. In the face of the gently rising water they were exercising the womanly prerogative of indecision. Suddenly they were engulfed by the water which continued to rise until it reached 45 feet above normal for the state of the tide; but it went up so gently that they had no trouble swimming to some nearby trees and saving themselves, with the baby. Their houses floated off and were wrecked.

When the waves had passed, it was found that 159 persons had been killed and 163 others injured. Besides considerable damage to commercial establishments, 488 homes were demolished and 836 damaged. Total property loss has been estimated at some twenty-five million dollars.

It is an interesting coincidence that one of the most learned marine geologists of the Pacific Basin happened to be on hand during this inundation. Professor F. P. Shepard of the Scripps Institution of Oceanography at La Jolla was staying at the house of Professor H. S. Palmer of the University of Hawaii at the time. The Palmer house is situated near the shore just west of Kawela Bay on the island of Oahu. Thus Professor Shepard had the opportunity to observe at first hand a phenomenon that he had been studying through the reports of other scientists for many years. As soon as it was possible after the disaster, he set about collecting all of the data he could uncover concerning the waves and their effects. He published the results of his study, together with G. A. Macdonald and D. C. Cox, in the *Bulletin* of the Scripps Institution of Oceanography in 1950. These great waves of 1 April 1946 are therefore among the best documented of such events.

Great waves, such as those which swept the Hawaiian Islands in 1946, are caused by major shifts in the shape of the ocean floor and have nothing at all to do with the tide. Thus their popular name of "tidal wave" is misleading. Oceanographers use several terms to describe them but the most commonly accepted is the Japanese word *tsunami*. This means "large waves in harbors."

Although earthquakes always accompany the faulting movements which cause tsunami, earthquakes may occur without producing such waves. For example, there have been about 1,000 earthquakes recorded in the San Francisco Bay area between 1850 and 1927, exclusive of the aftershocks following the larger quakes. About twenty of these were strong enough to damage masonry. And yet, in all that time only one tsunami has ever been produced on this coast.

As a matter of fact, the production of tsunami by faulting seems to be largely restricted to the great submarine trenches of the sea. For example, between 1819 and 1946, thirty-six tsunamis have been reported in the Hawaiian Islands. Of these, only three originated in the Hawaiian area; the others started in one submarine trench or another. Five of the thirty-six tsunamis were large enough to cause severe damage; one was local in origin, one came from the Aleutian Deep, and the other three came from the trench off the coast of South America.

The fact that most of the severe Hawaiian tsunamis have originated off South America is evidence of the instability of the Andean region of the Pacific. One of the worst of these occurred on 7 November 1837. At Honolulu, on the lee side of the Island of Oahu, at 6:00 P.M., the sea dropped about eight feet below its normal level, leaving the reefs dry and briefly stopping the usual roar of the surf. The wave oscillations did not cause much damage here, but they continued until the morning of 8 November. At Kahului, on the island of Maui, the water receded so as to leave the bottom of the bay bare for 120 feet from the shore; then it rolled landward as a terrifying wall of water that swept people and houses away. At Hilo, on the island of Hawaii, the recession of the water also left a large part of the harbor dry. Many people went out on

the floor of the harbor to collect stranded fish and were caught by the returning wave which reached 20 feet above the normal high water mark. Fourteen persons were drowned. The smallness of this figure is owing to the fortunate circumstance that there happened to be an English whaler anchored in the bay and she immediately launched her boats to cruise the harbor, picking up the survivors.

The only severe tsunami of local origin to hit the Hawaiian Islands followed the violent earthquake of 2 April 1868. The waves caused great damage all the way from South Cape to East Cape. The waves swept as much as a quarter of a mile inland along the south coast of Hawaii and reached a height of 50 to 60 feet above sea level. One hundred and eight houses were destroyed and 81 persons killed. Yet, in spite of this havoc on the Islands, the waves were barely noticed elsewhere.

This illustrates a general rule about the tsunami: large as the energies released at the source may be, the waves themselves transfer only a small portion of that energy to any particular trans-oceanic shore. The reason is that the energy is carried along an ever-increasing perimeter by waves radiating out from a source point; the farther the waves get from the center the greater is the circumference that they must span and the smaller is the energy content of any particular segment of the wave. Hence, although the tsunami may be immense in the immediate vicinity of the disturbance, as a rule they do little damage farther away.

A case in point is the tsunami that accompanied an earthquake in the Sanriku district of Japan on 15 June 1896. The disturbance there was very large. Some of the oscillations reached heights of nearly 100 feet on the coast of Japan, causing extensive loss of life and property. When these waves had crossed the Pacific to Honolulu, however, the largest was only 0.3 feet high from crest to trough. These same waves reached San Francisco 10 hours and 34 minutes after devastating the Japanese coast, but here they were barely perceptible on the tidal gauges.

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A. L. KROEBER:

PRESIDENT BENJAMIN IDE WHEELER in 1901 announced the establishment at the University of California, through the generosity of Mrs. Phoebe A. Hearst, of the first department of anthropology west of the Atlantic seaboard. Its head, he said, would be Dr. A. L. Kroeber,* who had come only the year before to the California Academy of Sciences in San Francisco as its curator of anthropology. I had spent most of my twenty-one years among the Indians of California and Oklahoma and had long wanted to pursue the subject of their culture. This, at last, was my opportunity. I at once enrolled as the first student in the new department and, in 1908, completed its first doctorate.

Kroeber was, in those early days, a "Vandyked" young man with a ready smile which immediately inspired confidence and yet with a quiet reserve which bespoke erudition. He was never given to dogmatic pronouncements but always weighed most carefully each bit of evidence before expressing an opinion.

* We are indebted to C. L. Alsberg for the details of Kroeber's early life and to R. H. Lowie for an appreciation of his scholastic accomplishments to 1936: *Essays in Anthropology, Presented to A. L. Kroeber in Celebration of his Sixtieth Birthday, June 11, 1936.* University of California Press, Berkeley, 1936. (Pp. xiii–xxiii.)

Since these great waves cause most of their damage only near their point of origin, one can imagine the magnitude of the violence released at the source of a tsunami that causes damage across thousands of miles of ocean. On 1 November 1755 an earthquake struck Lisbon, Portugal; this disaster is still famous for the loss of life and property and its effect on the Europe of that time. Yet almost all of the damage was caused by a giant wave so large it was still almost twenty feet high when it reached the West Indies.

From this we can infer how great was the turbulence at the epicenter of the wave of 1 April 1946 that reached heights of 55 feet after traveling two thousand miles across the Pacific. We have no eyewitness account of the disturbance at its source because the Alaskan coast is largely uninhabited. Dutch Harbor is the only major settlement anywhere near the scene of the faulting but it is protected by islands and a narrow, tortuous seaway. But at Scotch Cap Lighthouse, on the exposed south side of Unimak Island, the wave reached the greatest recorded height of the entire episode. Debris was deposited on a plateau 115 feet above sea level. The waves destroyed a radio mast whose base was 105 feet above the sea. The lighthouse itself, constructed of heavily reinforced concrete and with a base 45 feet above the sea, was completely demolished.

It was indeed fortunate that such a tremendous sea washed an uninhabited coast. If it had taken place off San Francisco, for example, as much as one-third of the city would have been inundated.

Although most tsunamis have resulted from major changes in the ocean floor, we have records of their occurrence after other phenomena. For example, one cause of small tsunamis can be seaside landslides. In Reggio Calabria, at the extreme tip of Italy, an earthquake struck on 5 February 1783. One of the worst damaged areas was the town and fortification of Scilla which is built on the promontory known in classical times as Scylla and where lay the great whirlpool of Charybdis described in the *Odyssey*. The Prince of Scilla, an elderly man by the name of Ruffo, tried to move his household inland to his castle of La Melia. But the road was blocked by rocks that had fallen from the mountains so he joined the people of the town on the beach just south of the promontory. At 7:30 P.M., part of Monte Baci, the next headland, thundered into the sea. The people on the shore could hear the roar of the sea as it was driven on the opposite shore of Faro across the straits. Then a vast returning wave was reflected that razed the beach below Scilla and swept away the prince, his household, and four thousand people of the town.

Another small tsunami that caused even greater loss of life occurred when the eastern side of Unzen volcano, in Japan, fell into the ocean in 1792. Waves of 30 feet or more in height were produced that, since the area was densely populated, killed more than 15,000 people.

Another series of great oceanic waves was produced by the famous explosion of a volcano on the island of Krakatoa. This has been called the most violent explosion in recorded human history. In a series of explosions on 26 and 27 August 1883, half of the island disappeared from the Sunda Strait and great waves were produced that swept the East Indies, killing more than 36,000 people. The largest of the waves was over 110 feet high. These waves did not enter the Pacific Ocean because of the configurations of the archipelagoes in that area but they did cross the Indian Ocean and enter the Atlantic. They reached the English Channel in 32.5 hours, but there they measured only a few inches.

WHEN REVIEWING *such phenomena as the tsunami, it is remarkably easy to be objective and matter-of-factly measure the strength of one wave against another. But to understand fully the reality of such events you must actually stand on an ominously silent shore one day and watch a cliff of water, a hundred feet high, advancing toward you, cresting up to crash like a giant breaker on the land. The terror that would grip you would give some notion of how insignificant we are before the awful forces in the universe.*

← (ABOVE) Two views of Hilo, Hawaii, after the tsunami of 1 April 1946. (Modern Camera Center, R. T. Kanemori, Hilo) (BELOW) A Honolulu dockside scene just after the great wave—retouched for newspaper use. (Honolulu *Star-Bulletin*)

That opinion was thereafter defended against all comers with an impregnable array of facts and logic. To the classroom he brought a fund of knowledge from various disciplines. To field problems he brought his wide experience in the Plains area, where he had already done extensive research for the American Museum of Natural History in New York before coming out to California.

In 1901 anthropology in California, and indeed all along the Pacific Coast, was an almost pristine field. What had been written about our far western Indians had been mostly journalistic reports or historical chronicles. Systematic study on a scientific foundation was now undertaken under Kroeber's guidance.

These were extraordinary student days. Very early I found myself assigned to field work in various parts of the state for, from the first, Kroeber sought to give his students opportunities for self-development through original work. My relationship with him was much more than the usual one between student and professor, and this was also the experience of many of his later students. I recall that in one course, in which I was the only student, I was not infrequently invited to dinner at an oyster house on Eddy Street in San Francisco. There, over the viands, I gave an account of my latest field work and together we planned future moves to solve our problems, for I was always made to feel that the project was a joint endeavor. I was not dealing with a professor on a pedestal. Ours was a partnership, and so it has remained throughout the years.

One of these projects arose, in part at least, from my earlier residence in Mendocino County and the fact that during the so-called "basket craze," which began early in the 1890's, I had explored almost every corner of the Coast Range from San Francisco Bay to Eel River—at least every corner where Indians lived—and had amassed a considerable fund of information on the geography and other features of this whole region.

Kroeber decided that I should cover this territory again, this time more systematically, and prepare the data for publication. The result was "The Ethno-Geography of the Pomo and Neighboring Indians," a sizable paper laboriously pecked out on my little Blickensderfer typewriter. This early "wheel"-type machine did not make very good carbons; besides, I was operating on a very small budget. There was, therefore, only one copy of the manuscript. Early in 1906 I had submitted it for publication and Kroeber had it in his office on the top floor of the Academy building, which then occupied its old Market Street location, where the Academy's Commercial Building now stands next to the Emporium.

At 5:14 on the morning of 18 April 1906, San Francisco felt the first and heaviest shock of its great earthquake. Many more devastating tremors followed. This catastrophe was attended by a conflagration which laid waste four square miles of the city's most populous downtown section. Shortly after I was shaken out of bed in Berkeley across the Bay, I saw the first mushroom of smoke arising from San Francisco. This reminded me that somewhere over there was that single copy of a manuscript which had cost me several years of hard labor. Only a few evenings before Kroeber and I had poured over it in his Academy office on the seventh floor. It must still be there. With a close friend, Austin Flanders, I made my way to San Francisco as soon as possible.

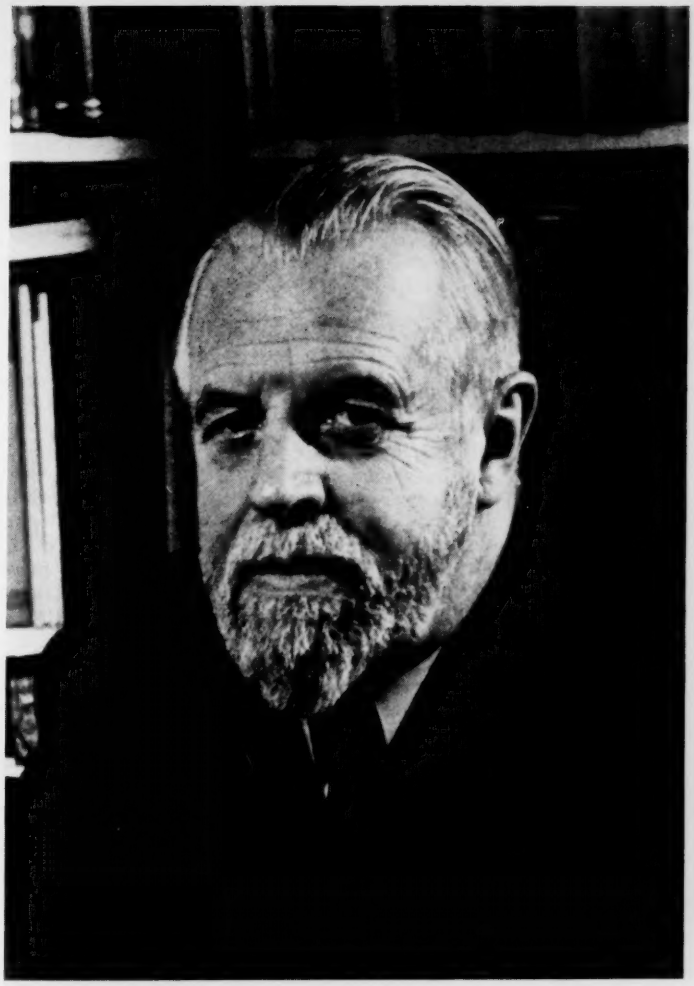
The waterfront was a shambles from the early shocks of the quake. What was worse, fire had already started in many places in the wreckage. Every water main in town was broken so there was nothing with which to fight these blazes, which were being fanned to fresh fury by a strong breeze off the Bay. It took us literally hours to skirt that part of the fire that was raging down in the Mission District and to come around to the front of the Academy building. Here we encountered some soldiers under the command of a young officer, who assured us that dynamite had already been set in the rear of this very building. To my plea that he withhold the firing of this charge for the few minutes that it would take me to run upstairs and rescue my precious manuscript he finally grudgingly agreed. But I had no idea of the journey ahead of me.

The first shocks of the quake had knocked out almost all the marble treads of the stairs. Worse yet, very many of the risers were gone. Scaling a mountain peak could not have equaled the climb up those six flights of stairs. Fortunately the banister was still pretty much intact, so up I went monkey fashion, with a firm hand hold on the banister but with a very shaky toe hold on what little was left of the stairs.

Kroeber's office door was wide open, but not a scrap of manuscript could be found, neither of my paper nor of several others which I had seen on my last visit.

Days later I learned what had happened. Kroeber at that time lived in San Francisco. Soon after the very first shock he went to the Academy, climbed those same fragmentary stairs, loaded all the manuscripts into a suitcase, and miraculously carried it down. That suitcase must have weighed tons before he reached the ground floor. How he got that load of manuscripts safely out the several miles to the Affiliated Colleges I do not know to this day. The quake had destroyed all transportation facilities and the streets were so filled with rubble that walking was most difficult.

My own descent from this seventh floor, even without encumbrance of any kind, was hard enough, but my simian efforts were finally rewarded. As I emerged from the front of the building, I beheld a most animated scene. A new officer was now in command and was ready to fire the dynamite planted in the other end of the building. Here was my friend Austin dancing about with arms flailing, shouting to convince the officer that he must hold that charge. The first words I caught were, "I tell you there are ten men up in that building! I saw them go up! You simply have to wait till they come down." Then he glanced around, saw me and added, "Oh! Go ahead and shoot. Here they come now, all ten of them!"



Alfred Louis Kroeber.
(Anthropology Department, UC.)

As we literally flew out of range up Market Street, the officer did "shoot." The whole building, housing the Academy's great scientific library and its priceless collections, including many type specimens, was soon a raging inferno.

The University's new Department of Anthropology grew rapidly under Kroeber's leadership; its faculty expanded, classes increased in number and size. A temporary museum sprang up on the Berkeley campus. A larger building on Parnassus Heights in San Francisco was assigned to house the vast collection which Mrs. Hearst's benevolence assembled for the University through the efforts of Reisner in Egypt, Emerson in Greece, Uhle in Peru, and various other field workers in North America and elsewhere.

Throughout these busy, formative years, however, Kroeber found opportunity to conduct field work of his own over a wide geographical range and to pursue special research problems in all branches of anthropology. He had always a ready but well balanced pen which has added to the literature of anthropology an exceptional list of publications, all of them products of mature consideration and a rare ability to interpret facts, assess values, and to preserve in permanent form the results of scientific research.

Recognition has been accorded Kroeber by election to high office in many learned societies, and over the years well merited honorary degrees have been awarded him: Sc.D., Yale, 1946; L.L.D., California, 1951; D.H.L., Harvard, 1952; Sc.D., Columbia, 1953. In 1945 he received the Huxley Medal of the Royal Anthropological Institute and in 1946 the Viking Medal.

In 1946 Kroeber reached the mandatory age of retirement at Berkeley. As Professor Emeritus of Anthropology and Director Emeritus of the Museum of Anthropology he might well have rested on his many laurels, but that was not his way. Repeated calls still made his store of knowledge available to students and colleagues elsewhere: as Visiting Professor, Harvard (1947–48), Columbia (1948–52), Brandeis (1954), Yale (1958), and as Fellow at the Stanford Center for Advanced Study in the Behavioral Sciences (1955–56).

Let us return again to those early years and to the oyster house on Eddy Street. One of Kroeber's earliest visions was of a building on the Berkeley campus devoted to instruction and research in anthropology, a fitting home for the Department of Anthropology and for the growing collections of the Museum of Anthropology. It is a long span from 1901 to 1959 but the air castles of those evenings on Eddy Street are now a reality. Appropriately named by the Regents of the University Kroeber Hall, the new building was occupied in June 1959. What could be a more fitting honor after sixty years of devotion? Only one: the universal esteem of his multitude of students and the high regard of his colleagues at home and abroad.

S. A. Barrett

The author (*left*) and Dr. Kroeber at the entrance to Kroeber Hall on the Berkeley campus, University of California, new home of Art and Anthropology departments. (D.G.K.)

FOCUS ON NATURE

UPON RECEIVING AN INVITATION to conduct a general nature column for *Pacific Discovery* I soon turned my thoughts to some of my own past experiences with nature. As I considered various possibilities for presenting nature, a kaleidoscopic parade of events indelibly etched on my memory marched before me.

I recalled hours of pushing through a dense tule marsh with Arthur A. Allen in search of White-tailed Kites; a two-hour chase after a giant Owl's Head Butterfly in a Vera Cruz jungle; a full eight-hour day (starting at 4 A.M.) spent 60 feet up a cottonwood tree in a blind photographing the family life of the Common Egret; a day's fossil collecting at the famed Florissant, Colorado fossil beds made easy by the help of 30 volunteer G.I.'s who preferred digging fossils to marching; a marvelous morning observing birds high on the slopes of Hawaii's Mauna Loa; numerous mountain peak ascents in search of arctic-alpine butterflies from Maine and New Hampshire to Colorado and California; and a recent all-too-brief visit to the Angelo Ranch in Mendocino County, a nature preserve of indescribable pristine beauty. Of these and many more events I will have more to say in the future.

I thought also of the great interest in nature that has been demonstrated in many ways in recent years. The popularity of the Walt Disney nature movies and publications is too well known to need further mention and the same is true of the wonderfully illustrated articles in *Life* magazine. Standing-room-only audiences at Audubon Screen Tour lectures have become routine.

People in all walks of life with all kinds of backgrounds find nature interesting. I recall a field trip of the Merced Natural History Society to observe water birds at the Los Banos Game Refuge some years ago. A brief notice had appeared in the Merced and Los Banos newspapers. Although members at that time numbered but 20 or so, more than 60 showed up at 6 A.M. Sunday morning. I recall that among them was a group of cowboys and their families down from the hills on a semi-annual shopping trip. They thought that the trip sounded more interesting than anything else they could do in town. I also remember a Los Angeles furniture salesman, staying in town to see another customer Monday morning, who was thankful that Merced offered such interesting activities.

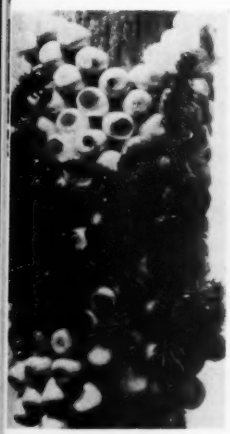
Interest in nature apparently remains high in the Merced area today judging by the highly successful Fourth International Nature Slide Show sponsored by the Merced Camera Club which held well-attended showings last month in Berkeley and San Francisco.

On these pages then, you will find commentary and observations about nature and naturalists, and reports on the interesting activities and discoveries currently taking place in field and laboratory.

You may also discover interesting things to see and do and from time to time you may check up on your own status as a nature observer with a nature photo quiz.

I will be glad to hear from you at any time and if you have specific questions about nature I will do my best to answer them. If you have any suggestions regarding other aspects of nature you would like to see covered on these pages please let me know about them.

Watch for the Nevada Buck Moth (*Hemileuca nevadensis*)*



MOST MOTHS AND BUTTERFLIES, if single-brooded, emerge as adults in the spring or early summer and most moths fly at night. The Nevada Buck Moth, however, ordinarily emerges during the period from mid-September to mid-November and flies during the day. The name "buck moth" derives (according to W. J. Holland in *The Moth Book*) from the fact that ". . . they fly at the time when deer stalking is in order."

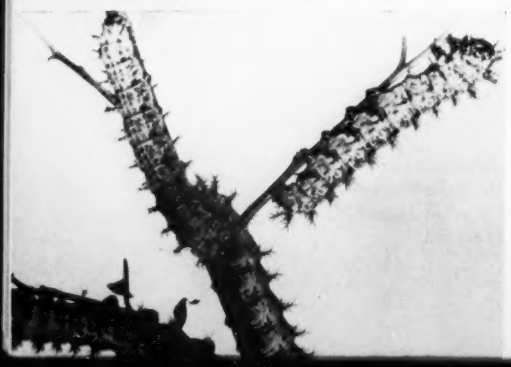
Eggs are deposited in a ring around small stems of the favored larval food plant much as are the eggs of the Mourning Cloak butterfly. The larvae will feed on the leaves of various species of *Salix* and *Populus* but within the range of Black Willow (*Salix Gooddingii*) a definite preference for that tree is shown.

Larvae emerge in the spring, reach the fifth instar by mid-June and by July normally pupate in the debris under the trees or in loose or sandy soil several inches below the surface. Care must be exercised in handling buck moth larvae because the prominent spines release an urticating secretion when touched. The effect is similar to the sting of nettle but more severe.

The wings of the adult are black and white and the abdomen brown or black with a reddish anal tuft. The flight is weak and erratic, quite in contrast to the flight of its day-flying close relative, the Sheep Moth (*Pseudohazis eglanterina*), which is very rapid and apparently purposeful.

The Nevada Buck Moth is distributed widely in California, Nevada, Colorado, Utah, Arizona, and New Mexico. Watch for these moths near willow or cottonwood. You can be almost certain of seeing them along Highway 152 between Los Banos and the San Joaquin River during October.

* The California Buck Moth (*H. californica*) is generally considered either synonomous with or a subspecies of *nevadensis* although another view holds that both are but subspecies of *H. maia*, the eastern species.



WITH ARTHUR C. SMITH

← Dr. Arthur C. Smith and his son, Terry, examine an insect catch. (R. J. Black)

What Do You Know About Nature?

BIRDS

(Photograph by Allan D. Cruickshank, Western Photo & Science Service)

LOOK AT THE PICTURE carefully and then answer the questions by filling in the blanks with a letter to indicate the correct choice to complete the sentence. Then turn to page 30 to see how much you know about this particular bird.

1. *This is a pair of baby* _____
A herons. **B** hawks. **C** owls. **D** vultures.

2. *The common name of this bird is* _____
A Barn Owl. **B** Monkey-faced Owl. **C** Screech Owl. **D** Chicken Hawk.

3. *This bird feeds primarily on* _____
A chickens. **B** pigeons. **C** insects. **D** rats, mice, and other rodents.

4. *This bird is generally considered* _____
A harmful to man. **B** beneficial to man.

5. *This kind of bird is found* _____
A only along the Gulf Coast from Florida to Texas. **B** only on the Pacific Coast from Seattle to San Diego. **C** only in sub-tropical Florida and California. **D** throughout most of the United States except for some of the more northern states.

6. *This bird nests* _____
A on the ground. **B** in hollow trees, caves, or deserted buildings. **C** in cat-tail marshes. **D** in grassy meadows.

7. *One family of these birds may consume as many as* _____ *rodents each day.*
A 25. **B** 50. **C** 100. **D** 250.

8. *The voice of this bird consists of* _____
A a hissing, snoring sound. **B** a rapidly repeated *hoo-hoo-hoo.* **C** a harsh, blood-tingling scream. **D** a mournful, quavering whinny, running down the scale.

9. *This bird, like all of its close relatives* _____
A is almost completely blind in sunlight. **B** can see in the daytime, although not as well as at night.

10. *"As wise as an owl" is* _____
A an appropriate saying as owls are among the most intelligent of birds. **B** an inappropriate saying as owls are neither wiser nor more intelligent than most other birds.

Stages in the life cycle of the Nevada Buck Moth. LEFT TO RIGHT: egg mass on a twig, larvae emerging; larvae feeding; pupae; adult. (Gayle Pickwell)

Space, Men, and Meteorites

ASTRONOMY

Guest Author:
PHILIP FERRY

THIS IS AN IMPROBABLE TALE. It begins with the chronicle of a hunting expedition from which the hunters returned empty-handed but happy nonetheless over the results of the chase.

During the fall hunting season of 1938 Clarence Schmidt, Joseph Secco, and Ira Iverson, all of Oakland, California, were hunting deer in the hills near Goose Lake in Modoc County, northern California, about a mile south of the Oregon line. The trio failed to bag any game but they did get a prize that brought them more satisfaction and bore more significance than a pair of trophy antlers.

While ranging the barren Modoc lava beds area one of the hunters came upon a curiously shaped object which he later described as looking like a giant molar. He struck the object with the butt of his gun and was startled to have it give off a bell-like tone, a sound so distinctive as to attract the attention of his two companions, who were some distance away. In this improbable manner the United States' fourth largest meteorite was discovered.

The specimen measured three feet by two feet by one foot and weighed more than a ton. One of the astronomers who later recovered the giant celestial visitor, F. C. Leonard of the Department of Astronomy at the University of California at Los Angeles, described the find as a "magnificent specimen."

Since the meteorite was located on government land, in this case Modoc National Forest, it belongs by law to the National Museum in the Smithsonian Institution.

Using horses and a wagon rented from local ranchers, the scientists moved the ungainly object over the rough lava beds to the nearest town, Alturas, 40 miles away. It took them three days to make this move. Here it was transferred to an auto truck and carted to San Francisco. The San Francisco International Exposition at Treasure Island was about to open and permission was obtained to place the object on display there during the seasons of 1939 and 1940, following which it was removed to the Smithsonian in Washington, D. C., where it has remained on display ever since.

For fifteen years the Goose Lake Meteorite served as a museum piece in the section of the Natural History building devoted to meteorites. Suddenly meteorites took on explosive importance. With the dawn of the Space Age, man quickly became aware that meteorites might have significance beyond that of natural curiosities. A meteorite is an object that has accomplished something man hopes to achieve: it has been places in the universe. Moreover, in making a landing on the planet Earth, a meteorite has licked one of the toughest problems confronting missile experts and engineers, namely, re-entry of the earth's atmosphere.

Re-entry is one of the truly crucial problems hampering space travel and some of the world's leading space scientists hope to wring the solution to this impasse out of the meteorites. Among the agencies now probing this possibility are the U. S. Air Force and the A.E.C. How have meteorites overcome the re-entry problem? Is it the metals they contain? Their metallurgical structure? Their composition?

A handful of experts believe it is a combination of all three and have applied themselves to the special study of meteorites in the hope of coming up with the answers to these posers. Among these experts is Edward P. Henderson, Associate Curator of the U. S. National Museum. Mr. Henderson has devoted thirty years to meteoritics, as the study of meteorites is called, and has given particular attention to the Goose Lake meteorite.

"For years," Mr. Henderson tells us, "the Goose Lake iron has been under study, the significance of its unusual features being debated at numerous conferences and discussions. The surface of this iron presents several absorbing mysteries. For instance, the iron's thin films of deformed metal range in thickness from one-sixteenth to three-sixteenths of an inch. These, we believe, are flow structures and represent the last physical change to take place on the iron during its flight through space. After studying these zones of deformed metal we found similar structures on other meteorites, a number of which showed the same typical Widmanstätten (basket weave) pattern. A well-defined example of this structure can be seen in the etched section of the Goose Lake meteorite."

While flight markings show plainly on the iron's surface, there is a surprising absence of impact scars. How could an object of such weight hurtle through space to collide with the earth without showing the effects of the impact? Such an omission hints that, (a) its terminal velocity was low, or (b) its impact with the earth was cushioned, or (c) there are a number of other intriguing possibilities.

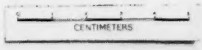
The size and shape of a meteorite affects its velocity during the fall. The greatest changes on a falling meteorite occur during the period of maximum deceleration, which is the brief moment it is in the earth's atmosphere. A meteorite of the weight of the Goose Lake iron, over 2,600 pounds, would crash to earth with a resounding impact, yet the Goose Lake iron is free of collision marks.

An equally mystifying aspect of the Goose Lake specimen is the cavities which pierce it like gigantic wormholes. Of these pits, Curator Henderson says: "Any description of the Goose Lake iron that neglected to mention its cavities would be incomplete. These cavities must have produced some weird noises as the iron rushed through space. Had the iron come to earth in a populated area rather than the sparsely settled lava beds section, the screaming meteorite would have provided the terrified citizenry with some interesting tales to tell.

"The origin of cavities is a complex subject," Henderson continues, "and only general theories of their formation are known. I believe the cavities in the Goose Lake meteorite existed before it entered the atmosphere—although this is not to say that all meteoric cavities are preflight."

Not all experts agree on the origin of cavities and on their overall influence on the behavior of meteorites. Mr. J. J. Cornish of the Engineering & Indus-

➔ Cross section through part of the Goose Lake meteorite, showing basket-weave structure after the cutting, grinding, and polishing of the surface metal. The scale shows 5 centimeters.



↓ Associate Curator Henderson inspects the Goose Lake Meteorite at the Smithsonian Institution. (Smithsonian Institution)

trial Research Station, State College, Mississippi, believes the cavities in the Goose Lake meteorite may have had something to do with the absence of impact scars on its surface. Cornish suggests that the cavities may have given the meteorite a measure of aerodynamic lift during the period of fall. "These cavities," says Cornish, "probably would give the body considerable spin during its fall. This spin could generate enough lift to reduce the velocity of the fall."

Is this a hint that here is a way of applying a braking action which would enable rockets to make a feather-light landing on celestial bodies?

NOTE: Principal source for portions of this article dealing with the Goose Lake meteorite is "Studies of Seven Siderites" by Edward P. Henderson and Stuart H. Perry, Bulletin No. 3388, *Proc. U.S. Nat. Mus.*, Washington, 1938. See also the article "Brickbats from Space" by Earle G. Linsley, *PD*, March–April 1949. Dr. Linsley, who had a hand in bringing the Goose Lake iron from its first resting place to Chabot Observatory, tells the story of its discovery in greater detail. Mr. Ferry is also indebted to Dr. Henderson through correspondence, and to various technical publications on problems of space, re-entry, rocketry, etc.—ED.

"Although one may only speculate as to the terminal velocity of the Goose Lake iron, indications are that it had a spectacular fall," Henderson conjectures. "The irregular shape indicates that it did not hold a fixed position during flight. The deformed metal shows that a strong lateral force was exerted on the surface during its fall. The side of the iron showing the most pronounced development of these zones was likely the forward surface during the last moments of high-velocity flight."

Slices of ⅜-inch thickness were cut from the edge of the metal and under analysis were found to be a nickeliferous iron containing schreibersite, kamacite, troilite, and taensite (kamacite is described as an iron-nickel alloy; taensite is a similar alloy but containing a higher percentage of nickel). Any missiles launched by man must of necessity be constructed of metals similarly capable of withstanding the terrific frictional heat that would be built up in re-entering the earth's atmosphere. It has been pointed out that one of the impediments to the development of reliable high-speed engines is lack of metals that will stand up to temperatures of 1600 to 2000° F.

"If either Russia or the United States should turn up an advanced alloy well ahead of the other," one metallurgist predicts, "it would give that nation a clean advantage in aircraft, jet engines, missiles, rocket motors and rocket weaponry."

Since meteorites have already made the passage through space and penetrated the earth's atmosphere, a study of their metallurgy may furnish a key to the alloys man must develop before he can truly embark on his conquest of space.

"Because the Goose Lake iron entered our atmosphere at high speeds and neither suffered much in its fall through the air nor when it collided with the earth, it could well hold the answer to the re-entry problem," opines Mr. Henderson.

Celestial migrants like the Goose Lake meteorite are truly messengers from outer space. The physical makeup of these heavenly bodies, their shape and the battle scars they bear, all may contain secrets man needs to solve in order to project that first journey through the universe. What is today called Outer Space may some day be only a far frontier being crossed regularly by man. Scientists hope that unlocking the mystery of meteoritic flight will speed the day when that frontier is crossed at last—as it has been crossed already by heavenly wanderers like the Goose Lake meteorite.

SKY DIARY

September, October, November, 1959

(Pacific STANDARD TIME except where noted)

Phases of the Moon		Daylight Saving Time
New Moon	September 2	6:55 P.M.
First Quarter	9	3:07 P.M.
Full Moon	16	5:51 P.M.
Last Quarter	24	8:22 P.M.
		Standard Time
New Moon	October 2	4:31 A.M.
First Quarter	8	8:22 P.M.
Full Moon	16	7:58 A.M.
Last Quarter	24	12:22 P.M.
New Moon	31	2:41 P.M.
First Quarter	November 7	5:23 A.M.
Full Moon	15	1:42 A.M.
Last Quarter	23	5:03 A.M.
New Moon	30	12:46 A.M.

(There are two new moons in October)

The Planets

Mercury: Best visible around November 3 in the evening twilight considerably south of the sunset position. It is 23° east of the sun on November 3.

Venus: Is in conjunction with the sun on September 1. It is directly south of the sun by 8½° and therefore is not visible. After September 1 Venus is a morning star. It reaches greatest brilliancy on October 8 and is farthest from the sun (46½°W) on November 12.

Mars: Invisible during September, October, and November since it is too near the sun. It is in conjunction with the sun on October 30.

Jupiter: A bright evening object in the southwest till early November when it appears too near the sun for easy observation. It moves from Libra into Scorpius during October.

Saturn: A fairly bright evening object (ranging from magnitude 0.6 in September to 0.8 in November) low in the south and southwest. It remains in the constellation of Sagittarius through the entire period, and becomes difficult to see in the twilight in November.

Earth: The earth is at the autumnal equinox on September 23, 11:09 A.M. P.S.T.

The earth will pass close to the orbit of comet Giacobini-Zinner on October 9 resulting in a meteor shower known as the Draconids. The nearest approach to the comet orbit is 5½ million miles on October 9. The earth arrives at this nearest point 20 days ahead of the comet. The comet on this day is 49 million miles from the earth. The nearest approach of the comet to the earth is 31½ million miles on October 31. The maximum of the shower occurs at 3:00 P.M. on October 9 and hence will not be visible in California. The shower should be visible in the eastern and middle parts of the North American continent in the early evening after twilight. The shower is not likely to be spectacular, as conditions are not as favorable as they were in 1946. The radiant is in the constellation of Draco. The comet itself never reaches naked eye visibility, its maximum brightness being magnitude 8.8. G.W.B.

FOCUS ON NATURE: ***Answers to Quiz on page 27—***

Allow ten points for each correctly answered question and then consult the scale below to see how you rate.

100 You are a top-notch field naturalist—at least on this bird!
80–90 You are a bird-watcher, first class.
60–70 You can qualify as a junior bird watcher.
50 You are probably a good arm-chair naturalist anyway.
below 50 Better stock to your knitting or join the nearest chapter of the National Audubon Society.

1. **C** owls. 2. **A** or **B** Barn Owl or Monkey-faced Owl. 3. **D** rats, mice, and other rodents. 4. **B** beneficial to man—actually one of the farmers' best friends although many farmers still shoot them on sight. 5. **D** throughout most of the United States except for some of the more northern states. 6. **B** in hollow trees, caves, or deserted buildings. 7. **C** 100. 8. **A** or **C** a hissing, snoring sound—usually heard from the nest or when at rest; and a harsh, blood-tingling scream—usually heard when in flight. 9. **B** can see in the daytime, although not as well as at night. 10. **B** an inappropriate saying—owls are neither wiser nor more intelligent than most other birds.

Barn Owls frequently nest close to man and his activities and—as our quiz points out—are quite beneficial. It is a deplorable fact that they are all too often used for target practice by those who are unaware of their great value. A.C.S.

(Continued from page 1)

effort in Antarctica (his line here should stop all "stoppers": "I sat drinking whiskey at the Pole one night with George Dufek. . . ."). He quotes freely from Admiral Dufek's *Operation Deepfreeze*, but gives this as direct from his host at the American South Pole base: " 'If the IGY find the answers to its questions, it will affect almost every field of human activity—shipping, construction, air travel, agriculture, radio communications, navigation. . . . These 18 months will be worth a billion dollars to the free world's rocket programme. . . . All of us here . . . are in at the turning point of space knowledge'." Invoking an earlier hero of white deserts Barber goes on: "And there was another, even more fundamental reason which the polar explorer Fridtjof Nansen gave for man's restless quest after knowledge. It is of no purpose, he believed, to discuss the use of knowledge. Man wants to know and when he ceases to be curious, he will no longer be man.

"Into this great field of adventure, there slowly moved the puny, magnificent, impertinent effort of Vivian Fuchs, determined to cross the world's last frontier for the first time in history." This effort, which Sir Edmund Hillary shared so controversially with Dr. Fuchs, "was to prove a journey of infinite value not only to science but to the spirit of adventure which is what makes man man."

So, then, *The White Desert* is the story of the singularly romantic episode which, in all the mighty drama of ten nations operating more than 60 stations with all possible technological and logistic resources, most certainly epitomized in the world's imagination the age-old struggle of man against nature, of human brain and muscle opposed to impersonal and inexorable forces. It is also a very human drama of the forces within man's own nature, "the story of two strange and restless men, Fuchs and Hillary, so similar in courage, so different in character; differences that caused bitter feeling between the two explorers that no platitudinous phrases can cover up, . . . revealed to me from my curious vantage point between the two of them. . . ." — the vantage point of the Pole itself, where Barber waited to get the world-beating story of the convergence of two straggling lines of tiny tractors in a 2,000-mile expanse of white desert.

Endurance: *Shackleton's Incredible Voyage.* By Alfred Lansing. McGraw-Hill Book Company, Inc., New York. 1959. viii + 282 pp., illus., endpaper map. $5.00.

"In appreciation for whatever it is that makes men accomplish the impossible"—this is the dedication the youthful journalist and free-lance writer Alfred Lansing has given his first book, *Endurance.* The title is the name of the ship in which Sir Ernest Shackleton sailed to the Weddell Sea in 1914 with his Imperial Trans-Antarctic Expedition. There he would land on the ice shelf and set out by dogsled and foot to cross Antarctica, bringing to Britain the glory of the last great first land crossing on earth, to himself—fame and fortune. But, beset by the worst ice in years, the *Endurance* was crushed like a nut in a vise. Shackleton took his men 180 miles over ice to Elephant Island opposite Cape Horn. Here with five of his 27 men he set out in a whaleboat to cross 800 miles via Drake Passage—the most terrible sea on earth—to reach help at the whaling station on South Georgia Island, and accomplished one of the epic small boat voyages of all time. Landing on the west side of South Georgia, he took two men and walked across the glacier-bound mountainous island—a feat considered impossible. Lansing has put the story together from the actual diaries of the men, from letters, and interviews with those alive today, creating a sure classic of exploration and Antarctica. It took a Vivian Fuchs to make good on Shackleton's purpose, 44 years later; but in merely surviving and returning to the world of men, the *Endurance* party gained an equal place in the explorers' hall of fame. The story could not be better told than it has been here.

From the Columbuses to the doves

Wild Paradise: *The Story of the Coto Doñana Expeditions.* By Guy Mountfort. Introduction by Field Marshal the Viscount Alanbrooke. Houghton Mifflin Company, Boston. 1958. 240 pp., 130 photographs by Eric Hosking, endpaper maps. $7.00.

Where Spain's westward Río Guadalquivir flows into the Gulf of Cádiz there stands the small seaport town of Sanlúcar de Barrameda. From here in 1498 Columbus sailed on his third voyage to the New World; and in 1519 Magellan embarked here on the first voyage round the world. The mouth of the Guadalquivir has other significance now. Back of its beachhed lie swamps—Las Marismas—and *cotos,* hunting preserves: Coto del Rey, and particularly the Coto Doñana, ancient seat of the Dukes of Medina Sidonia (one of whom was the ill-starred *almirante* of the Invincible Armada). This riverine association of marshes, moors, woodlands and dunes, where the remaining 67,000 acres of a one-time "Doña Ana's" hunting preserve are guarded by Las Marismas on the east and 40 km. of white sand beach on the west, is an area of international importance today. Military?—a British field marshal is involved. No. Alanbrooke, Mountfort and company are bird watchers, along with Roger Tory Peterson, James Fisher, François Bourlière, and many others—a high-ranking international group of men, and women, dedicated to the proposition that there is both room and need in our world for falcons and curlews and cranes and warblers, and also lynxes and lizards, shrews and stone pines. For here in the Coto Doñana Europe's wildlife is making one of its final stands for survival. In 1952, 1956, and 1957 parties of leading British, French, Spanish, and American naturalists undertook the detailed observation, checklisting, and evaluating of the wild treasure of this small area so exceedingly rich in bird and animal species —especially birds, which makes *Wild Paradise* above all a bird lovers' book, but still, a fine and beautiful book of adventure and exploration in an unexpected and little known part of the world. It serves, at the same time, to remind us that the nations must share a common concern for the preservation of what wilderness is left.

Mexico, way inside

Mexican Journal: *The Conquerors Conquered.* By Selden Rodman. The Devin-Adair Company, New York. 1958. xvi + 298 pp., numerous photographs, endpaper map. $6.

An additional legend on the title page describes this lively, highly personal affair quite well: "A journal of six months in Mexico including travels to the principal parts of that country; conversations with distinguished personalities in the arts and public life; adventures, mishaps, reflections and photographs." It is just short of embarrassing at times in its intimacy with celebrities, but the author carries enough weight to be entitled to throw it around a bit to good effect.

To promote biological literacy

With the school year upon us again—"us" including parents and teachers, aunts and uncles and grandparents, all concerned with what our children read or with helping them answer questions about the world around them—there is an increasing list of good books to have around

Bouquets and back numbers

OUR GOOD FRIEND *and constant reader C. M. Goethe of Sacramento, California, has kindly shared with us a letter from Dorothy Edwards Shuttlesworth, founder of the* Junior Natural History Magazine, *and author of* Exploring Nature with Your Child *(Greystone Press, New York, 1952) and many other books:*

Pacific Discovery [May–June 1959] arrived and is of interest in more ways than one. First, because of the excellent antelope article with its comparison to the thoroughbreds. Then, the story on "Buenaventura" with the discovery of Lake Tahoe. Of course they don't mention Fallen Leaf Lake, but they (Frémont's party) must have paused to admire that beautiful spot! We all enjoyed tracing Frémont's route—remembering our own travels across the Sierra. . . . The additional matter of interest is seeing such an attractive new magazine—"new" to me, at any rate. . . . I'd say the California Academy of Sciences is doing a fine job. . . .

Frémont could not have seen Fallen Leaf Lake, in all probability, since he viewed Tahoe from the heights to the southwest and did not go down to the lake level. We appreciate the nice compliments from Mrs. Shuttlesworth and thank Mr. Goethe for passing them on.—ED.

EDITOR, *Pacific Discovery:*

First, I want to thank you for putting out such a marvelous magazine; and second, I want to ask how it is possible that so many of us have not seen or heard of it before? . . . This summer I was taking a class in the Library School at San Jose State and twice during the class made excellent use of your magazine, once in a planned unit on Australia and New Zealand and the other time on a group report of magazines. Each time there was great interest in the magazine, and I am sure there are many subscriptions that will come in as a result. Even our teacher, from Illinois, was intensely interested in it as a magazine for curriculum source material.

I am writing this letter, then, for two purposes: to thank you for putting it out, and suggesting that you ought to do more to let people know how marvelous it is. . . . Are (back issues) available?

MABEL B. CRITTENDEN (MRS. MAX D., JR.)
Librarian
Portola Valley School,
Menlo Park, California, 1 September 1959.

Needless to say, letters like this make many a hard day's work well worth while. Only one thing has kept us from telling more people what a wonderful magazine we have, and it isn't modesty—it is the high cost of all forms of wholesale word-spreading. We are full of ideas for showing our product, not only to teachers from Illinois but to everyone from Missouri—and all points west. Getting our ideas on the road is the problem. Meanwhile, if every year each reader were to get us one other (for reader, read subscriber)—you figure it out!

As for back issues, most are still in print, at the regular price for singles or $2.50 for six (commercial).—ED.

Another gratifying bouquet comes from the editorial offices of Frederick A. Praeger, publisher, New York; we thank these kind people again for their favor in the use of Malcolm MacDonald's Angkor *excerpts, and we certainly appreciate this:*

What a lovely article on Angkor! . . . In presentation and photography they don't came much better.

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the home or the classroom. Just a few of dozens of possible titles can be mentioned in our space:

The earth itself is about as basic a subject as we could begin with. Not juvenile, but high school to adult level, are: **Our Earth:** *the properties of our planet, how they were discovered, and how they came into being,* by Arthur Beiser (E. P. Dutton & Co., Inc., New York. 1959. 123 pp., photos, drawings. $3.95); **Living Earth,** by Peter Farb (Harper & Brothers, New York. 1959. ix + 178 pp., photos, drawings. $3.75). Dr. Beiser's book makes a good layman's or high school student's background reading for understanding the why of the IGY—the search for answers to some of the unknowns of geophysics. Mr. Farb is concerned with life—the ecology of soil, forests, grasslands, deserts—and the mutuality of survival, the wholeness or oneness of life. For going into a particular part of the story in more detail, there is **The Living Forest,** by Jack McCormick (Harper & Brothers, New York. 1959. 127 pp., numerous photos and drawings. $3.95). Dr. McCormick, who is in charge of Vegetation Studies at the American Museum of Natural History, has based this exciting book on the material in the new (May 1958) Hall of North American Forests in the New York institution. The collaborating artist, Matthew Kalmenoff, is also on the Museum staff; and the AMNH coöperated with Harper in the publication. For going into the past, the AMNH staff has again come up with something first rate in **Millions of Years Ago:** *Prehistoric Life in North America,* by Edwin H. Colbert (Thomas Y. Crowell Company, New York. 1958. 153 pp., illustrated with line drawings by Margaret M. Colbert. $2.75). This is listed as 10–14 age level, but it is a book to recommend to anyone, the author being the well known AMNH curator of fossil reptiles and amphibians, and it being greatly enhanced in attractiveness by Mrs. Colbert's drawings.

Two items for field more than indoor use, at adult level: Fossil hunting and rock hunting being closely allied field activities, **The Rock-hunter's Field Manual:** *a guide to identification of rocks and minerals* is a handy thing to have along in either case (the fossil hunter must know his rocks to recognize his fossil horizons). This rather bleak looking but nonetheless useful item is by D. K. Fritzen of Oakland, California (Harper & Brothers, New York. 1959. xii + 207 pp., illus. $3.50). Too bad the only illustrations are five cold little line cuts of collecting equipment, and 62 outline drawings of "Mineral Crystals and Fragments"—it takes the unfortunately quite costly halftone and color plates to attract the beginner and amateur collector.

Skin-diving, shark scares, and other aquatic considerations being to the fore, *PD's* sometime author Bruce W. Halstead, M.D., is very timely with his manual of **Dangerous Marine Animals** (Cornell Maritime Press, Cambridge, Maryland. 1959. 146 pp., frontis. in color, 86 halftone and line figs. $4.00). This book by a medico-biological expert in the field should become a must for all who operate in and about the sea in any way exposed to its biotic hazards. Many years of research have gone into the preparation of this fully indexed manual.

For 8–12 or younger, the story kind of thing has the strongest attraction. Robert M. McClung, who does this sort of thing without mushiness, has added another to his list: **Whooping Crane** (William Morrow & Company, New York. 1959. 64 pp., wash drawings by Lloyd Sandford. $2.50). Naturally there is a strong conservation pitch, but it doesn't preach. D.G.K.

A. W. Anthony with bobcat shot from window of San Diego Natural History Museum. (Mus. coll.)

academically speaking

THROUGH AN ERROR made at the turn of the century, the California Academy of Sciences has in its possession irreplaceable botanical specimens which all concerned had long given up as being sadly and irrevocably lost in the earthquake and fire of 1906. This brief tale with its alliterative elements of collecting, Californiana, confusion, conflagration and finally, kindly consideration (which gives the story its happy ending) goes something like this:

Late in the 19th century, Mr. A. W. Anthony, a science-minded correspondent to the Academy, purchased a schooner named the *Wahlberg*. Previously, the *Wahlberg* had had a checkered career, to say the least. Among her dubious activities were the transport of a cargo of rifles from San Francisco to the Sandwich islands; and she was once a member of a guano poaching fleet which had headquarters in San Diego and did its collecting on the islands west of the Coast of Baja California. Once, she was angrily captured by the Mexican government when at anchor at San Martín.

After purchase by Mr. Anthony, the *Wahlberg* turned legitimate. In 1897, she made a memorable scientific expedition in search of botanical specimens along the coast of Baja California. One member of the expedition was Townshend Stith Brandegee, an incurable botanist and life member of the California Academy of Sciences. His wife, Mary K. Curran, was from 1883 to 1894 curator of the Academy's herbarium. It is from Mr. Brandegee's account of the 1897 trip that this prefatory information was gleaned.

The *Wahlberg* landed at nearly all of the islands west of the Baja California coast, and continued to Socorro, Clarion, and San Benedicto. The expedition was a success, so much so that it was possible to forward numerous specimens to many of the botanical centers of the world. On the list of recipients was the Royal Botanic Garden in Edinburgh, Scotland.

As to the actual mailing, one may only conjecture. The day was warm, the packager sleepy, the list of addressees so arranged that it would not be too difficult to duplicate an address to a distant place. That is what must have happened, for not one but *two* packages of duplicate specimens went their watery way to the land of kilts and heather.

In the fury and the fire of the 1906 holocaust in San Francisco, the Academy's collection of Baja Californiana literally went up in smoke. The institution for which the expedition and collection had primarily been made was without, and only the idlest, most wishful thinking would include the hope that it would or could ever be replaced.

Fifty-three years pass.

On 11 August 1959, another warm day, a large, carefully-wrapped, inconspiciously brown package arrived at the desk of Mr. John Thomas Howell, the Academy's curator of botany. Through the thoughtful generosity of the staff of the Royal Botanic Garden at Edinburgh, the duplicate specimens of dried flora of Baja California collected during an historical and memorable trip a half-century ago had once again come home. H.R.

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